THE New Schoolmaster's Assistant,

OR

SCHOLAR's EASY GUIDE

TO

ARITHMETIC.

IN FIVE PARTS.

WHEREIN

I. The Rules of Addition, Subtraction, Multiplication, and Division, both simple and compound; Reduction and the Rules of Proportion are briefly and methodically considered, and elucidated by proper Examples.

II. The mercantile Rules are delivered in a copious and extensive Manner, and diversified with a great Variety of useful Examples.

III. The Rules of Alligation, Position, Progression, &c. are laid down in the most simple and easy Manner.

IV. The Doctrine of Fractions, both Vulgar and Decimal, are clearly and distinctly treated of:—To which are added Involution, and Evolution, or the Extraction of Roots. Interest, both simple and compound; Equation of Payments, &c. &c.

V. Duodecimals are copiously explained, and applied to Glaziers', Plasterers', Joiners', Painters', Paviors', and Bricklayers' Work, &c. &c. To which are annexed a very large Collection of useful Questions, exercising all the Rules in the Book.

DESIGNED PRINCIPALLY FOR THE USE OF SCHOOLS,

AND THE

INSTRUCTION OF YOUTH INTENDED FOR TRADE AND BUSINESS.

Being an Abridgement of the COMPLETE PRACTICAL ARITHMETICIAN, with the Answers to the several Questions annexed.

By THOMAS KEITH,

Teacher of the Mathematics, Author of a Short and Easy Introduction to the Science of Geography, the Complete Practical Arithmetician, &c. &c.

LONDON:

PRINTED FOR E. LAW AND SON, [illegible]-LANE.

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AT MR. KEITH's SCHOOL, HEDDON-COURT, SWALLOW-STREET,

YOUTH

ARE

CAREFULLY AND EXPEDITIOUSLY INSTRUCTED,

IN THE

VARIOUS BRANCHES OF EDUCATION

REQUISITE TO

QUALIFY THEM FOR TRADE AND BUSINESS.

SUCH as are deſigned for or belong to the ſea, may be taught Navigation in the courſe of a few weeks; the new method of finding the Latitude by double Altitudes of the Sun, &c. and of finding the Longitude by the Lunar Obſervations, according to any of the methods hitherto publiſhed for that purpoſe; with the uſe of the ſeveral inſtruments uſed at ſea, charts, maps, globes, &c.

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PREFACE.

RESPECTING the matter contained in the enſuing Treatiſe, little need be ſaid, as this is not the firſt time it has appeared in the world. Suffice it to obſerve that the rules are laid down in as plain * and conciſe a manner as poſſible; and the examples are all, or moſt of them, ſuch as daily occur in trade and buſineſs, of which there are a great variety. Theſe eſſentials united, are to be met with in few Treatiſes of Arithmetic, written purpoſely for the uſe of ſchools; this work therefore will, it is hoped, be found a valuable acquiſition to thoſe teachers, whoſe primary object is to inſtruct youth deſigned for a commercial line of life. It is divided into five parts, as expreſſed in the title-page and table of contents; theſe parts are arranged in the ſame order as they are generally taught in ſchools, in and near the metropolis; but, as Mr. *Dilworth* obſerves, ſcarcely two maſters follow the ſame arrangement; "Some like to "teach that rule firſt, which another thinks more con-"venient to teach afterward; while a third looks upon "it as a matter quite indifferent, among ſome rules, "which he teaches firſt. But this need be no hindrance "to the uſe of this book. For however the rules are "placed here, every man may turn to that rule firſt, "which he likes ſhould be taught firſt, and if a maſter "has a mind to teach Vulgar Fractions immediately af-"ter Reduction of whole Numbers, as ſome do, he "may do it as eaſily as in the order they now lie."—I

* See the Monthly Review for October, 1789, reſpecting the Complete Practical Arithmetician, of which this Treatiſe is an Abridgement.

confeſs it to be my opinion, and I ſpeak from experience, that an early acquaintance with Vulgar and Decimal Fractions is the only method of laying a good foundation for forming an able accountant; for which reaſon, if the ſcholar had ſufficient time to ſtay at ſchool, I would teach him Fractions and Decimals immediately after the Rule of Three, and direct him to make uſe of them occaſionally through every future rule.—Fractional examples are eaſy for the ſcholar to work by the ſeveral rules, but when he comes to apply them he is generally at a loſs, and ſeldom gets maſter of them; this can only be the effect of learning them but a little time before he leaves ſchool, and of courſe he has but few queſtions to apply them to.

Algebraical Rules, and Mathematical Characters, have, as far as poſſible, been avoided in the enſuing Treatiſe, for I conſider them as an unneceſſary clog upon the memory of a youth deſigned for trade. Demonſtrations of the rules, &c. upon ſcientific principles, have, for a ſimilar reaſon been omitted; theſe are the proper province of perſons converſant in, or deſigned for the ſtudy of the higher departments of mathematical knowledge, and conſequently improper to be introduced in a commercial ſyſtem of arithmetic.

In part the firſt the reader will find a great variety of uſeful rules and examples; Compound Multiplication, Compound Diviſion, Reduction, and the Rule of Three are conſiderably extended. Such examples as are marked with an aſteriſm (*) are not taken from the Complete Practical Arithmetician, but are placed in the room of others which were thought rather too difficult for young beginners. The Bills of Parcels marked (10) iv. ſignifies that the 10th bill in this work is the 4th in the Treatiſe from which this is extracted; and the example, page 51, marked (54) xxx. ſhews that it is the 30th example in the Rule of Three, &c. of the reſt.

Tare and Tret, Intereſt, &c. are copiouſly delivered; and Loſs and Gain, which has puzzled moſt writers, is laid down in a plain and eaſy manner, and the young ſtudent may depend upon the truth of the ſeveral rules;

ſhould the critic diſpute their authenticity, he may conſult the demonſtrations at page 47 of the Appendix to the Complete Practical Arithmetician. Exchange is likewiſe delivered in a clear and comprehenſive manner.

Vulgar Fractions are given in as ſhort and clear a manner as poſſible. The examples are preciſely the ſame in ſubſtance as thoſe in the Complete Practical Arithmetician, and are arranged in the ſame order, only differently expreſſed. Complex Fractions I have placed under diviſion, by which means I have ſaved four rules. Dilworth's 9th and 10th caſe only contain half the forms of Complex Fractions that may occur; the ſame may be obſerved of Walkinghame's 10th and 11th caſe.

I have omitted Circulating Decimals as of little conſequence to youth intended for trade and buſineſs; but the inquiſitive reader will find them treated of in a more *correct* and *comprehenſive* manner in the Complete Practical Arithmetician and the Key, than in any other book extant.

Duodecimals, commonly called Croſs Multiplication, are treated in a copious and extenſive manner; and a large collection of practical queſtions are added to exerciſe all the rules in the book; the firſt marked K 52, page 3, ſhews it to be the 52d ſolution at page 3d of the Key, &c. of the reſt.

Heddon-Court, Swallow-ſtreet.

LONDON, Nov. 1791.

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4 *The*

EXPLANATION

Explanation of the Characters made Uſe of in the following Work.

Charact.	*Names.*	*Significations.*
+	Plus, or more,	the Sign of Addition, as $2+4$ ſignifies that 2 and 4 are to be added together.
−	Minus, or leſs,	the Sign of Subtraction, as $8-3$ ſignifies that 3 is to be ſubtracted from 8.
×	multiplied into or by,	the Sign of Multiplication, as 7×5 ſignifies that 7 is to be multiplied into or by 5.
÷	divided by,	the Sign of Diviſion, as $9\div3$ ſignifies that 9 is to be divided by 3; and $\frac{9}{3}$, or $3)9($, ſignifies the ſame.
=	equal to	the Sign of Equality, as $9=9$ ſignifies that 9 is equal to 9; or $\overline{5+4}-2=7$ ſignifies that 5, increaſed by 4 and diminiſhed by 2, is equal to 7.
: :: :	Proportion	as 2 : 4 :: 8 : 16 ſignifies that 2 is to 4 as 8 is to 16

The other Characters are explained among the Definitions in the Work.

ERRATA.

In the 4th Bill, page 38, for 10s. read 0s.
In the 13th 40, for 59l. read 591.
Page 67, Ex. 178, for 551l. &c. read 550l. &c.

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TO

ARITHMETIC.

PART I.

(§1.) DEFINITIONS.

1. ARITHMETIC is the art of computing by numbers; and consists of two parts, viz. whole Numbers, and Fractions vulgar or decimal.

2. *Arithmetic in whole Numbers* supposes its numbers to be entire quantities, and not divided into parts.

3. *Arithmetic in Fractions* supposes its numbers to be parts of some whole quantity.

4. *Number* is either an *Unit*, or a *multitude* of Units; viz. it is the name of that idea, or notion, we conceive of things considered as *one*, or *many*. Every multitude has a distinct name, as two, three, four, &c. and an unit is the beginning of number.

5. *A whole Number* is a precise number without any part, or parts, annexed.

6. *A mixed Number* is a whole number with ſome part, or parts, annexed.

7. *An even Number* is that which will divide into two equal whole numbers.

8. *An odd Number* is that which cannot be divided into two equal whole numbers.

9. *A prime Number* is that which can only be meaſured by an unit.

10. *Numbers* are ſaid to be prime to each other when only an unit meaſures both.

11. *A ſquare Number* is the product of a number by itſelf.

12. *A cube Number* is the product of a number and its ſquare.

13. *A compoſite Number* is that produced by multiplying two or more numbers together.

14. *A perfect Number* is that which is equal to the ſum of all its aliquot parts.

15. *An aliquot Part* is that which is contained a preciſe number of times in another.

16. *An aliquant Part* is ſuch as is contained in another a certain number of times, with ſome part, or parts, over.

17. *An Integer* is any whole thing, or ſingle Figure.

18. *Digits*, or *Figures*, are the marks by which numbers are expreſſed, and are the nine following, viz. 1 one, 2 two, 3 three, 4 four, 5 five, 6 ſix, 7 ſeven, 8 eight, 9 nine; to which we may add the cipher 0, which is of no value when taken by itſelf; yet, when it is placed on the right or left hand of any figure, increaſes or diminiſhes it tenfold.

19. *The nature of all Arithmetical Operations*, is by ſome quantities that are given, to find out others that are required.

20. *The*

20. *The principal, or fundamental Rules of Arithmetic*, are Notation, and Numeration which informs us in what manner we are to exercise and accommodate numbers to the various purposes of business.—*Numeration* consists principally of four parts, viz. Addition, Subtraction, Multiplication, and Division.

21. *A Proposition* is something proposed to be done, or proved.

22. *An Axiom* is a self-evident proposition, and cannot be rendered more plain by demonstration.

23. *A Theorem* is a demonstrative proposition, wherein the nature and property of a thing is proposed to be proved.

(§ 2.) NOTATION.

Definition. Notation is the art of expressing numbers by figures; and teaches us to read, or write down, any number, and to have a clear and distinct idea of every figure in it.

NOTATION TABLE.

Hundreds of Millions	Tens of Millions	Millions	Hundreds of Thousands	Tens of Thousands	Thousands	Hundreds	Tens	Units
								1
							2	1
						3	2	1
					4,	3	2	1
				5	4,	3	2	1
			6	5	4,	3	2	1
		7.	6	5	4,	3	2	1
	8	7.	6	5	4,	3	2	1
9	8	7.	6	5	4,	3	2	1

1. Write

1. Write down in words at length the following numbers.

49	437	17349	149387
75	305	10807	1078400
1075	1087	314815	30180070
378	47318	107048	108374108

2. Write down in proper figures the following numbers.

Eighty-nine. Seven hundred and fifty. Five thouſand and one. Ten thouſand and eighty-ſeven. Twenty thouſand and five.

Six hundred and eighty-five thouſand, three hundred and ſixty.

One million, five hundred thouſand, and one.

Twenty ſeven million, three hundred and ſixty-five thouſand.

Three hundred and eighty-five millions, ſeven hundred and forty-eight thouſand, three hundred, and five.

Eleven thouſand, eleven hundred, and eleven.

Fifty million, fifty thouſand, fifty hundred, and fifty.

(§3.) SIMPLE ADDITION.

Definition. *Simple Addition* is a Rule by which ſeveral numbers of one denomination are collected together into one ſum.

RULE.

Place the numbers under each other, viz. Units under units, tens under tens, &c. add up the figures in the row of units, and carry as many units to the next row as there are tens contained in the ſum: proceed thus till the whole is finiſhed.

For the Proof. Divide the numbers to be added into two parts, then add up each part by itſelf, and collect theſe ſums together for the whole.

(1.)	3247	(2.)	14934	(3.)	143716
	.....		31493		371419
	1498		47184		143714
	3471		37149		171349
	4734		14734		371493
	8714		34718		471348
	4374				
Sum	26038	Sum	180212	Sum	1673039
	22791				
Proof	26038				

(4.) Add 1473, 40734, 371049, 40057, 3471473, 5734, 37492, and 4718375, together.

(5.) Collect 371434, 278949375, 67149, 3457143, 714934, 9000987, and 5734747, into one ſum.

(6.) Add 5714329, 4718714, 34983714, 671493, 74987149, 6777894987, and 19, together.

(7.) Add 571493, 40007, 6493497, 4718349, 3714934, 4934938, 174934, and 147349, together.

(8.) Suppoſe the diſtance from *London* to *Biggleſwade* be 45 miles, thence to *Peterborough* 36, thence to *Lincoln* 51, and thence to *Hull* 41 miles; how many miles are *Peterborough*, *Lincoln*, and *Hull*, from *London*?

(§4.) SIMPLE SUBTRACTION.

Definition. *Simple Subtraction* teaches to deduct, or ſubtract, a leſs number from a greater of the ſame denomination, whereby the remainder, or difference, is found.

RULE.

Place the leſs number under the greater, ſo that units may ſtand under units, tens under tens, &c. Begin at the unit's place, and ſubtract each figure in the lower line from

the figure above it; if the lower figure be greater than the upper, add *ten* to the upper figure, from which ſubtract the lower; ſet down the remainder, and carry *one* to the next lower figure.

For the Proof. Add the remainder and leſs number together, and the ſum will be the greater. Or, ſubtract the remainder from the greater number, and the difference will be the leſs.

(1.) From 9437149 minuend.	(2.) 473494	(3.) 494871	(4.) 347149
Take 1349348 ſubtrahend.	193487	194985	134948
Diff. 8087801			
Proof 9437149			

(5.) From 47348 take 13456.
(6.) From 194938 take 149542.
(7.) From 5007149 take 171493.
(8.) From 1493487 take 149349.

(9.) From the creation of the flood was 1656 years; thence to the building of Solomon's Temple 1336 years; thence to Mahomet, who lived 622 years after Chriſt, 1630 years. In what year of the world was Chriſt then born, and how many years is it ſince the creation?

(10.) Sir Iſaac Newton was born in the year 1642, and died in 1727, how old was he at the time of his deceaſe, and how many years is it ſince he died?

(§5.) SIMPLE MULTIPLICATION.

Definition 1. *Simple Multiplication* is a rule by which we increaſe the greater of two given numbers of the ſame denomination, as often as there are units in the leſs; being a compendious method of performing Addition.

2. The number to be multiplied is called the *Multiplicand*; the number you multiply by is called the *Multiplier*; and

the number produced, by Multiplication, is called the *Product*.

THE MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Propoſition 1. *To multiply by a ſingle figure, or any number not exceeding* 12.

Rule. Begin at the unit's place of the multiplicand, and multiply each figure in it by the multiplier, writing down the whole of ſuch products as are leſs than 10; but, for ſuch as exceed 10, or a number of tens, write down the exceſs, and carry an unit, for each 10, to the next product.

(1.) Multiply 471347325
by 2

Product 942694650

(2.) Multiply 371493407 by 3.
(3.) Multiply 47048743 by 4.
(4.) Multiply 57134974 by 5.
(5.) Multiply 37180753 by 6.
(6.) Multiply 4900757149 by 7.
(7.) Multiply 3714937187 by 8.
(8.) Multiply 4708714371 by 9.
(9.) Multiply 5714937143 by 10.
(10.) Multiply 3715714936 by 11.
(11.) Multiply 149371574 by 12.

Prop.

Prop. 2. *When the multiplier is the product of two or more numbers in the Table.*

Rule. Multiply the multiplicand by one of the component parts, and that product by the other, &c. for the whole product.

(12.) Multiply 47134987 by 56.

8

377079896

7

Product 2639559272

(13.) Multiply 47134784 by 21.—Anſ. 989830464.
(14.) Mult. 37149374 by 22.—817286228.
(15.) Mult. 47187413 by 24.—1132497912.
(16.) Mult. 7493456 by 63.—472087728.
(17.) Mult. 4194734 by 72.—302020848.
(18.) Mult. 3175493 by 77.—244512961.
(19.) Mult. 39007149 by 84.—3276600516.
(20.) Mult. 71340987 by 96.—6848734752.
(21.) Mult. 47154734 by 132.—6224424888.
(22.) Mult. 704134795 by 144.—101395410480.

Prop. 3. *When the multiplier conſiſts of ſeveral figures.*

Rule. The multiplicand muſt be multiplied by each figure ſeparately, and the firſt figure of every product muſt ſtand exactly under the figure you multiply by. Add theſe products together for the whole product.

For the Proof. Multiply the multiplier by the multiplicand, and, if the product be the ſame with *that* of the multiplicand by the multiplier, the work is right.

(23.) Mul-

(23.) Multiply 471493475
By 4395

2357467375
4243441275
1414480425
1885973900

Product 2072213822625

Proof by multiplication.

4395
471493475

21975
30765
17580
13185
39555
17580
4395
30765
17580

2072213822625

(24.) Multiply 430714934 by 743.—Anſ. 320021195962
(25.) Mult. 37157437 by 14972.—556321146764
(26.) Mult. 47157149 by 37495.—1768157301755
(27.) Mult. 5714937 by 47159.—269510713983
(28.) Mult. 47134749 by 371895.—17529177479355
(29.) Mult. 3704957 by 4713759.—1746274403363

Prop. 4. *When ciphers are intermixed with the figures in the multiplier.*

Rule. Omit the ciphers, and let the firſt figure of each product be placed under its reſpective multiplier.

(30.) Multiply 4713457
By 5704008

37707656
18853828..
32994199.
23567285

26885596435656

(31.) Mult.

Anſwers.

(31.) Mult. 371493407 by 700505.—260232989070535
(32.) Mult. 57040935 by 5040648.—287523274925880
(33.) Mult. 40750493 by 67100805.—2734390884446865
(34.) Mult. 371493471 by 57080507.—21205035671869797
(35.) Mult. 4070490385 by 4090805.—16651582419409925
(36.) Mult. 5417080574 by 3905008.—211537429781145 92

Prop. 5. *When there are ciphers at the end of the multiplicand or multiplier.*

Rule. Neglect the ciphers, and multiply as before; then to the right hand of the product annex as many ciphers as were omitted.

(37.) Multiply 47150000
By 3980000

37720
42435
14145

Product 187657000000000

(38.) Mult. 471000 by 40700.—Anſ. 19160700000
(39.) Mult. 507000 by 30500.—15463500000
(40.) Mult. 4713000 by 6070500.—28610266500000
(41.) Mult. 3075600 by 30500700.—93807952920000
(42.) Mult. 57867000 by 4007500.—231902002500000

(§6.) SIMPLE DIVISION.

Definition 1. *Simple Diviſion* is a Rule by which we find how often one number is contained in another of the ſame denomination; being a ſhort method of performing Subtraction.

2. The

2. The number to be divided is called the *Dividend*, the number you divide by is called the *Diviſor*; and hence will ariſe a third number, called the *Quotient*, which ſhews how often the Diviſor is contained in the Dividend. If the Diviſor does not exactly meaſure the Dividend, a fourth number will occur, called the *Remainder*, which muſt always be leſs than the Diviſor.

Propoſition 1. *When the Diviſor does not exceed* 12.

Rule. Obſerve how often the diviſor is contained in the firſt, or firſt and ſecond, figure of the dividend, and ſet the quotient-figure under it: carry 10 for every unit remaining after ſubtraction to the next figure of the dividend; proceed thus, multiplying and ſubtracting mentally, till you have made uſe of all the figures in the dividend.

(1.) Divide 174934234 by 2.

Diviſor 2) 1749342345 Dividend.

Quotient 874671172 — 1 Rem.

(2.) Divide 471349571 by 3.
(3.) Divide 407104937 by 4.
(4.) Divide 70407143 by 5.
(5.) Divide 170049378 by 6.
(6.) Divide 493740075 by 7.
(7.) Divide 30871050743 by 8.
(8.) Divide 41375714937 by 9.
(9.) Divide 71000571479 by 10.
(10.) Divide 37407184374 by 11.
(11.) Divide 47105713475 by 12.

Prop. 2. *When the Diviſor is a compoſite number.*

Rule. Divide the dividend by one of the component parts, and that quotient by the other, for the required quotient. If there be a remainder to each of the quotients, multiply the laſt remainder by the firſt diviſor, and to that product add the firſt remainder for the true one.

(12.) Divide

(12.) Divide 7149347859 by 25.

$25 = 5 \times 5$) 7149347859

5) 1429869571—4 } Rem.
Quotient 285973914—1 } $9 = 1 \times 5 + 4$

Rem.

(13.) Divide 7349473857 by 27.—Anſ. 272202735.—12
(14.) Divide 749347549 by 144.—5203802.—61
(15.) Divide 649305743 by 55.—11805558.—53
(16.) Divide 4730715405 by 121.—39096821.—64
(17.) Divide 3704095714 by 108.—34297182.—58
(18.) Divide 4710437154 by 132.—35685129.—126
(19.) Divide 1071540075 by 99.—10823637.—12
(20.) Divide 457014374 by 96.—4760566.—38

PROPOSITION 3.

When the Diviſor conſiſts of ſeveral figures.

RULE.

Find how many times it may be had in as many figures of the dividend as are juſt neceſſary; multiply the diviſor by the quotient-figure, ſubtract the product from that part of the dividend which ſtands above it, and to the right hand of the remainder bring down the next figure in the dividend, which number divide as before; and ſo on till all the figures in the dividend are brought down.

For the Proof.

Multiply the quotient by the diviſor, to the product add the remainder, if any, and the ſum will be equal to the dividend.

(21.) Divide

(21.) Divide 34674378 by 95.

Divisor	Dividend	Quotient	Rem.
95)	34674378 (	364993—43.	
	285	95	
	·617	1824965	
	·570	3284937	
	··474	43	Remainder.
	··380	30674378	Proof by multiplication.
	···943		
	···855		
	····887		
	····855		
	·····328		
	·····285		
	·····43		

Rem.

(22.) Divide 714394756 by 1754.—Anſ. 407294.—1080

(23.) Divide 47159407184 by 3574.—13195133.—1842

(24.) Divide 5719487194715 by 45705.—125139201.—Rem. 13010

(25.) Divide 471571493714938 7 by 17493.—Anſ. 26957725588 2.—5561

(26.) Divide 671493471549375 by 47143.—Anſ. 14243757748.—35411

(27.) Divide 57194300714 5 by 37149.—15395919.—Rem. 12214

(28.) Divide 1714347149347 by 57143.—30001000.—Rem. 6347

(29.) Divide 4937154714937 5 by 374567.—Anſ. 131809655.—104990

(30.) Divide 1714937159471 43 by 571007.—Anſ. 300335575.—273118

(31.) Divide 675437149567159 4 by 678957.—Anſ. 9948157977.—81605

Prop. 4. *When the Dividend hat ciphers on the right hand.*

Rule. Cut off the ciphers from the diviſor by a daſh of your pen, and alſo cut off as many ciphers, or figures, from the dividend. But when the diviſion is finiſhed, the ciphers omitted muſt be reſtored to their proper places, and the figures cut off in the dividend muſt be placed to the right hand of the remainder.

(32.) Divide 14715967899 by 145000.

145000) 14715967899) 101489 $\frac{62899}{145000}$ Quotient.

145

215
145

709
580

1296
1160

1367
1305

62899 Rem.

Or thus,

145000) 14715967899 (101489 $\frac{62899}{145000}$.
215
709
1296
1367

62899 Rem.

(33.) Divide 571436490075 by 36500.—Anſ. 15655794.—Rem. 9075

(34.) Divide 194718490700 by 73000.—2667376.—Rem. 42700.

(35.) Divide 795498347594 by 47150.—16871651.—Rem. 2944.

(36.) Divide 1495070807149 by 371500.—4024416.—Rem. 263149.

(37.) Divide 6714934714934 by 754000.—8905748.—Rem. 722934.

(38.) Divide 10714914714307 15 by 147500.—Anſ. 7264348958.—125715.

(39.) Divide 1471493749371 4957 by 157900.—Anſ. 93191497743.—95257.

(40.) Divide 714937494719 4715 by 1749000.—Anſ. 4087692937.—381715.

(§ 7.) TABLES

(§7.) TABLES OF ENGLISH COIN, WEIGHTS, MEASURES, &c.

TABLE I. MONEY.

The loweſt piece of money uſed in England is a farthing, and all accounts are kept in pounds, ſhillings, pence, and farthings.

2 Farthings	-	make	1 Halfpenny.
4 Farthings	-	—	1 Penny.
6 Pence	- -	—	Half a ſhilling.
12 Pence	-	—	1 Shilling.
2 Shillings and 6 pence		—	Half-a-crown.
5 Shillings	-	—	1 Crown.
5 Shillings and 3 pence		—	A Quarter-guinea.
10 Shillings and 6 pence		—	Half-a-guinea.
21 Shillings	-	—	1 Guinea.
20 Shillings	-	—	1 Pound (an imaginary coin).

Note.

£ denotes pounds, s. ſhillings, and d. pence.
¼ ——— a farthing, or the quarter of any thing.
½ ——— a halfpenny, or the half of any thing.
¾ ——— three farthings, or three-quarters of any thing.

Imaginary Engliſh Coin.

A mark, value	13s.	4d.	An angel, value		10s.
A noble ——	6	8	A Carolus ——		23
A groat ——	0	4	A Jacobus ——		25

SHILLINGS and PENCE TABLES.

	£.	s.		£.	s.
20 Shillings	1	0	130 Shillings	6	10
30 ———	1	10	140 ———	7	0
40 ———	2	0	150 ———	7	10
50 ———	2	10	160 ———	8	0
60 ———	3	0	170 ———	8	10
70 ———	3	10	180 ———	9	0
80 ———	4	0	190 ———	9	10
90 ———	4	10	200 ———	10	0
100 ———	5	0	210 ———	10	10
110 ———	5	10	220 ———	11	0
120 ———	6	0	230 ———	11	10

		s.	d.			s.	d.
20	Pence	1	8	80	Pence	6	8
24	——	2	0	84	——	7	0
30	——	2	6	90	——	7	6
36	——	3	0	96	——	8	0
40	——	3	4	100	——	8	4
48	——	4	0	108	——	9	0
50	——	4	2	110	——	9	2
54	——	4	6	120	——	10	0
60	——	5	0	130	——	10	10
70	——	5	10	132	——	11	0
72	——	6	0	144	——	12	0

TABLE II. TROY WEIGHT.

By this weight are weighed gold, silver, jewels, amber, and all liquors.

24 Grains -	make	1 Pennyweight, dwt.
20 Pennyweights	——	1 Ounce, oz.
12 Ounces	——	1 Pound, lb.

TABLE III. APOTHECARIES WEIGHT.

Apothecaries, Chemists, &c. use this weight in mixing medicines; but buy and sell their drugs by avoirdupois weight.

20 Grains	make	1 Scruple, *scr.*
3 Scruples	——	1 Dram, *dr.*
8 Drams	——	1 Ounce, *oz.*
12 Ounces	——	1 Pound, *lb.*

TABLE IV. AVOIRDUPOIS WEIGHT.

By Avoirdupois weight are weighed such commodities as are coarse and dressy, or subject to waste, as groceries of all kinds, bread, butter, cheese, and most other common necessaries of life; pitch, tar, resin, wax, tallow, flax, &c. as are likewise all metals, silver and gold excepted.

16 Drams -	make	1 Ounce
16 Ounces -	——	1 Pound
28 Pounds -	——	1 Quarter of an Hundred Weight
4 Quarters, or 112 Pounds,	——	1 Hundred-weight, Cwt.
20 Hundred-weight	——	1 Ton

There

There are ſeveral ſorts of ſilk weighed by the great pound of 24 ounces, others by the common pound of 16 ounces. Hence, to reduce great pounds to common, multiply by 3 and divide by 2; and, to bring common pounds into great, multiply by 2 and divide by 3.

Note. A pound avoirdupois is equal to 14 oz. 11 dwts. 15½ grains troy. Hence the avoirdupois pound is to the troy pound as 6999½ is to 5760, or nearly as 17 to 14; and the avoirdupois ounce is to the troy ounce as 437½ is to 480, or nearly as 73 to 80.

A firkin of butter, 56lb.
——— ſoap, 64lb.
A barrel of raiſins, 112lb.
——— ſoap, 256lb.
A puncheon of prunes, 1120lb.
A fother of lead, 19½ cwt. or 2184lb.
A ſtone, horſeman's weight, 14lb.
——— butcher's meat in London, 8lb.
——— ditto in the country, 14lb.
A gallon of train-oil, 7½lb.
A truſs of ſtraw, 36lb.
——— new hay, 60lb.
——— old hay, 56lb

	lb.	oz.	dr.
A load, 36 truſſes.			
A peck-loaf weighs	17	6	0
A half-peck	8	11	0
A quartern	4	5	8

Wool-weight.

A clove, or half-ſtone,	7lb.
A ſtone, or 2 cloves,	14lb.
2 ſtone, or 1 todd,	28lb.
A wey, or 6½ todds,	182lb.
A ſack, or 2 weys,	364lb.
A laſt, or 12 ſacks,	4368lb.

TABLE V. CLOTH-MEASURE.

Cloth-meaſure is uſed by Linen and Woollen Drapers. Hollands are meaſured by the Engliſh ell, and tapeſtry by the Flemiſh ell; woollens, linens, wrought-ſilks, tape, &c. by the yard.

2¼	Inches	make	1 Nail.
4	Nails	—	1 Quarter of a yard.
3	Quarters	—	1 Flemiſh ell.
4	Quarters	—	1 Yard.
5	Quarters	—	1 Engliſh ell.
6	Quarters	—	1 French ell.

TABLE VI. LONG MEASURE.

This meaſure is uſed to meaſure diſtances, lengths, breadths, heights, depths, &c. of places or things.

12	Lines, or 3 barley-corns,	make	1 Inch.
12	Inches - -	—	1 Foot.
3	Feet - -	—	1 Yard.
6	Feet, or 2 yards -	—	1 Fathom.
5½	Yards, or 11 half-yards	—	1 Rod, Pole, or Perch.
4	Poles, or 100 links	—	1 Chain.
40	Poles, or 10 chains	—	1 Furlong.
8	Furlongs, or 80 chains	—	1 Mile.
3	miles - - -	—	1 League.
60	geographical miles, or 69½ statute-miles -	—	1 Degree.

Note. The ſtatute-pole is 5½ yards, but in ſome counties in England they reckon 6 yards to the pole; in the north of England 7 yards are accounted a pole, or rod.

TABLE VII. SQUARE-MEASURE.

Square meaſure is uſed to meaſure all kinds of ſuperficies; ſuch as land, paving, flooring, plaſtering, roofing, ſlating, tiling, and every thing that has length and breadth.

Square			*Square*
144	Inches - -	make	1 Foot.
9	Feet	—	1 Yard.
30¼	Yards, or 272¼ feet,	—	1 Pole, rod, or perch.
16	Poles - -	—	1 Chain.
40	Perches - -	—	1 Rood.
4	Roods, or 160 rods, or 4840 yards, or 10 chains	—	1 Acre.
640	Acres - - -	—	1 Mile.
100	Feet - - -	—	1 of Flooring.

TABLE VIII. CUBIC, OR SOLID MEASURE,

Is uſed, in menſuration, to meaſure all kinds of ſolids, or ſuch figures as conſiſt of three dimenſions, viz. length, breadth, and depth, or thickneſs.

Cubic			*Cubic*
1728	Inches -	make	1 Foot.
27	Feet -	—	1 Yard.
166⅜	Yards -	—	1 Pole.
64000	Poles -	—	1 Furlong.
512	Furlongs -	—	1 Mile.

40 feet of rough timber, or 50 feet of hewn timber, 1 ton, or load.

TABLE

TABLE IX. WINE-MEASURE.

By this measure all wines, brandies, rum, spirits, distilled liquors, cider, perry, mead, vinegar, honey, oil, &c. are measured, bought, and sold.

4 Gills	make	1	Pint.
2 Pints	—	1	Quart.
4 Quarts, or 2 Pottles	—	1	Gallon.
10 Gallons	—	1	Anchor of brandy.
18 Gallons	—	1	Runlet.
31½ Gallons	—	1	Barrel, or half-hogshead
63 Gallons	—	1	Hogshead.
42 Gallons	—	1	Tierce.
84 Gallons	—	1	Puncheon.

2 Hogsheads, or 126 gallons, make 1 Pipe, or butt.
2 Butts, or 4 hogsheads, or 252 gallons, make 1 ton.

Note. In the north of England a gill is half a pint; also, the measure of a gill, in London, is there called a *jack*.

TABLE X. ALE AND BEER MEASURE, *in London*.

By this measure all malt-liquors are gauged, bought, and sold.

2 Pints	make	1	Quart.
4 Quarts	—	1	Gallon.
8 Gallons	—	1	Firkin of Ale.
9 Gallons	—	1	Firkin of Beer.
2 Firkins, or 18 gallons	—	1	Kilderkin.
32 Gallons	—	1	Barrel of Ale.
36 Gallons	—	1	Barrel of Beer.
48 Gallons	—	1	Hogshead of Ale.
54 Gallons	—	1	Hogshead of Beer.
2 Hogsheads, or 96 gallons	—	1	Butt of Ale.
2 Hogsheads, or 108 gallons	—	1	Butt of Beer.

Note. The above measure is used only in London for gauging and selling: in all other places, in England, the following Table is the standard of ale and beer measure, according to a statute of excise made in the year 1689.

TABLE

TABLE XI. ALE AND BEER MEASURE, *in the Country.*

2	Pints - -	make	1 Quart.
282	Cubic inches, or 4 quarts,	—	1 Gallon.
8½	Gallons - -	—	1 Firkin.
17	Gallons -	—	1 Kilderkin, or ½ barrel.
34	Gallons -	—	1 Barrel.
51	Gallons -	—	1 Hogſhead.

Note. Notwithſtanding the above ſtatute, common brewers, in ſome parts of the country, allow 36 gallons to the publicans for a barrel of ale or beer.

TABLE XII. DRY MEASURE.

Dry-meaſure is uſed in meaſuring all *dry* commodities, as wheat, barley, beans, and other grain; fruit, roots, ſand, ſalt, coals, oyſters, &c.

2	Pints -	make	1 Quart.
2	Quarts - -	—	1 Pottle.
2	Pottles, or 8 pints	—	1 Gallon.
2	Gallons -	—	1 Peck.
4	Pecks - -	—	1 Buſhel.
4	Buſhels -	—	1 Coom.
2	Cooms, or 8 buſhels,	—	1 Quarter.
4	Quarters -	—	1 Chaldron.
5	Quarters -	—	1 Wey.
2	Weys, or 10 quarters,	—	1 Laſt.

For Coals.

4	Pecks -	make	1 Buſhel.
3	Buſhels -	—	1 Sack.
36	Buſhels -	—	1 Chaldron.
21	Chaldrons -	—	1 Score.

Note, 32 buſhels make a chaldron in the country: 5 pecks make a buſhel water-meaſure: 5 buſhels make a ſack of flour. The ſtandard Wincheſter-buſhel is a cylinder of 18½ inches diameter and 8 inches in depth.

TABLE

TABLE XIII. MEASURE OF TIME.

60 Thirds	make	1	Second.
60 Seconds	—	1	Minute.
60 Minutes	—	1	Hour.
24 Hours	—	1	Day.
7 Days	—	1	Week.
4 Weeks	—	1	Month.

13 months 1 day, or 52 weeks 1 day, or 365 days, a year, for three years together: but every fourth year contains 366 days, and is called leap-year. Hence the Julian year is 365 days 6 hours at a mean.

The common year is alſo divided into 12 Calendar Months.

Memorandum.—30 days hath September,
April, June, and November,
February has 28 alone,
And all the reſt have 31.

In a leap-year, which happens every fourth, February has 29 days.

A TABLE, ſhewing the number of days from any day of one month to the ſame day of any other month in the ſame year.

To the ſame Day of	From any Day of											
	Jan	Feb	Mar.	Apr.	May.	June	July.	Aug.	Sep	Oct	Nov.	Dec
Jan.	365	334	306	275	245	214	184	153	122	92	61	31
Feb.	31	365	337	306	276	245	215	184	153	123	92	62
Mar.	59	28	365	334	304	273	243	212	181	151	120	90
Apr.	90	59	31	365	335	304	274	243	212	182	151	121
May	120	89	61	30	365	334	304	273	242	212	181	151
June	151	120	92	61	31	365	335	304	273	243	212	182
July	181	150	122	91	61	30	365	334	303	273	242	212
Aug.	212	181	153	122	92	61	31	365	334	304	273	243
Sept.	243	212	184	153	123	92	62	31	365	335	304	274
Oct.	273	242	214	183	153	122	92	61	30	365	334	304
Nov.	304	273	245	214	184	153	123	92	61	31	365	335
Dec.	334	303	275	244	214	183	153	122	91	61	30	365

Note. In leap-year, if the end of the month of February be in the time, one day muſt be added on that account. To know when it is leap-year, divide the year by 4, and the remainder ſhews how long it is after leap-year; if nothing remains, it is leap-year.

TABLE

TABLE XIV. Of Number.

12 Units	make	1 Dozen.
12 Dozen	—	1 Groſs.
12 Groſs, or 144 dozen,	—	1 Great Groſs.
20 Units	—	1 Score.
5 Score	—	1 Short hundred.
6 Score	—	1 Long hundred.
24 Sheets	—	1 Quire of Paper or Parchment.
20 Quires	—	1 Ream of ditto.
2 Reams	—	1 Bundle of ditto.
12 Skins of Parchment	—	1 Roll.

(§ 8.) COMPOUND ADDITION.

Definition. *Compound Addition* is a rule by which ſeveral numbers, of different denominations, are collected together into one ſum.

Rule.

Place the numbers ſo that thoſe of the ſame denomination may ſtand directly under each other. Add the firſt row, or loweſt denomination, together, as in Simple Addition, and divide the ſum by as many of the ſame denomination as make one of the next greater: ſet down the remainder, and carry the quotient to the next ſuperior denomination. Proceed thus through all the denominations to the higheſt, which add as in Simple Addition.

The method of proof is the ſame as in Simple Addition.

Note. Addition of money may either be performed by the preceding rule, or by the help of the pence-table.

MONEY.—*See Table* I.

(1.)

£.	s.	d.
174	11	4½
.....		
74	19	11¾
64	13	10
174	19	11¾
64	18	10¾
105	11	9¾
74	19	10¾
44	18	11¾
Sum 779	14	7¼
605	3	3
Proof 779	14	7¼

(2.)

£.	s.	d.
374	11	5¼
74	12	7¾
149	14	10¾
74	14	11½
104	13	10
105	17	11¾
74	19	10¾
16	14	7¾
Sum 976	0	2

(3.)

£.	s.	d.
174	11	4¼
39	18	10¾
714	14	7¾
64	19	11¼
108	14	9
74	14	7¼
64	13	10
174	19	4
67	12	5
149	15	9¾
74	14	7

(4.)

£.	s.	d.
147	14	9¾
77	11	4¾
10	10	10¼
7	7	4
19	4	11¼
19	3	10¾
14	10	11
74	13	9¾
104	14	9¾
74	12	10¾
16	18	5¼

(5.)

£.	s.	d.
149	14	7¼
37	11	9¾
64	14	7
104	19	11¼
64	13	10
174	19	11¼
47	14	10¾
39	15	11½

(6.)

£.	s.	d.
14	11	3¼
19	18	10
77	11	3¼
49	14	7
16	18	4½
17	15	10
1	14	9¼
6	18	10¾

(7.)

£.	s.	d.
14	19	4¼
17	11	10
39	18	11¼
19	14	9
19	15	11¼
18	19	10
77	19	11¼
14	11	10¼

(8.)

£.	s.	d.
14	10	4¼
77	18	3
14	13	9¾
67	12	4¾
9	11	10
18	10	5
17	19	4
19	10	4

TROY WEIGHT.—*See Table* II.

(9.)

lb.	oz.	dwt.
174	11	19
74	10	13
944	9	14
74	11	19
944	10	13
74	11	3
14	9	4
77	10	11

(10.)

oz.	dwt.	gr.
174	19	23
714	11	14
714	0	18
74	1	22
948	2	21
74	1	12
715	2	14
714	18	16

(11.)

lb.	oz.	dwt.
71	11	19
64	8	14
77	0	0
14	3	11
64	2	9
74	1	14
77	2	13
19	2	14

(12.)

oz.	dwt.	gr.
74	19	23
64	14	17
74	19	11
66	13	9
74	14	11
14	10	3
19	11	14
17	10	13

APOTHE-

APOTHECARIES WEIGHT.—*See Table* III.

(13.) lb.	oz.	dr.	(14.) oz.	dr.	scr.	(15.) dr.	scr.	gr.	(16.) lb.	oz.	dr.
47	11	7	149	7	2	749	2	19	84	11	7
94	10	6	714	3	0	607	1	18	74	10	6
74	10	4	619	2	1	714	2	17	37	5	4
75	9	3	74	6	2	400	0	0	19	4	3
69	0	2	169	5	2	74	1	13	74	1	2
57	1	2	74	1	2	715	2	14	79	2	6
18	2	1	777	6	1	64	1	18	19	2	4
74	1	2	948	5	2	174	2	19	74	9	5

AVOIRDUPOIS WEIGHT.—*See Table* IV.

(17.) T.	cwt.	qr.	(18.) Cwt.	qr.	lb.	(19.) Qr.	lb.	oz.	(20.) lb.	oz.	dr.
174	19	3	174	3	27	44	27	15	17	15	15
74	14	2	714	2	24	74	26	14	27	14	11
714	13	3	149	1	14	19	14	13	16	13	9
718	16	2	719	2	16	74	19	14	74	14	14
734	15	2	407	1	23	66	27	13	70	0	0
714	14	1	149	2	17	74	19	10	64	13	10
700	13	2	714	2	18	14	18	11	74	14	11

CLOTH MEASURE.—*See Table* V.

(21.) Yds.	qr.	n.	(22.) E. E.	qr.	n.	(23.) Ells Fr.	qr.	n.	(24.) Ells Fl.	qr.	n.
74	3	3	77	4	3	749	5	3	714	2	3
64	2	1	14	3	2	704	4	2	615	1	2
74	1	3	74	2	1	108	3	1	714	1	3
49	2	1	49	1	2	705	4	0	724	2	2
74	1	2	74	2	1	708	3	1	149	1	2
44	3	1	74	3	2	474	5	2	718	2	3
74	2	0	44	1	2	174	0	1	419	1	1
14	1	2	74	2	3	194	3	2	710	1	2

LONG

LONG MEASURE.—*See Table* VI.

(25.)

Lea.	m.	f.
17	2	7
14	1	6
74	1	7
69	2	4
74	1	0
69	2	1
74	1	2
94	0	3

(26.)

F.	p.	yds.
147	39	5½
614	37	4½
714	19	3½
674	17	1½
719	27	2½
197	19	1½
714	14	3½
704	19	4½

(27.)

P.	yds.	ft.
177	5½	2
714	4½	1
714	1½	2
615	0	1
714	1½	2
719	1½	1
437	2½	1
614	1½	2

(28.)

Feet.	in.	b.c.
174	11	2
49	10	1
74	11	2
64	9	1
74	10	1
64	11	2
74	10	0
64	9	1

SQUARE MEASURE.—*See Table* VII.

(29.)

A.	r.	p.
77	3	39
64	2	37
74	1	24
64	2	19
74	1	18
64	2	17
14	1	13
74	2	11

(30.)

A.	r.	p.
714	3	39
619	1	18
714	2	27
619	1	34
719	2	37
719	1	24
615	2	14
74	1	18

(31.)

A.	r.	p.
14	3	39
74	1	19
64	2	14
74	1	18
47	2	24
18	1	14
74	2	19
34	1	14

(32.)

A.	r.	p.
174	3	39
714	1	27
618	2	12
719	1	14
734	2	11
715	1	24
639	2	14
714	3	24

WINE MEASURE.—*See Table* IX.

(33.)

Tuns	hhd.	gall.
714	3	62
614	2	61
174	1	39
164	2	47
274	1	49
175	2	37
375	1	49
714	2	61

(34.)

Pun.	gal.	qt.
714	83	3
615	81	2
714	74	1
614	18	2
713	75	0
614	17	1
715	14	3
719	28	2

(35.)

Tierce	gall.	qt.
74	41	3
64	40	2
74	19	1
64	39	2
74	40	1
69	19	1
17	39	2
18	41	1

(36.)

Gall.	qt.	pts.
14	3	1
74	2	1
39	2	1
17	1	0
19	2	0
77	1	1
39	3	1
14	1	1

ALE AND BEER MEASURE.—*See Table* X.

(37.) B.B.	fir.	gall.	(38.) A.B.	fir.	gall.	(39.) A.hhd.	gall.	qt.	(40.) B.hhd.	gall.	qt.
74	3	8	73	3	7	714	47	3	714	53	3
14	2	7	69	2	6	614	44	1	415	47	2
16	1	4	14	1	7	374	43	2	714	19	1
17	1	3	39	2	2	157	41	1	614	27	1
29	2	2	19	1	6	719	42	1	715	51	2
17	1	7	49	2	6	374	41	2	714	37	2
41	2	6	37	1	4	174	12	1	615	19	1
37	1	5	19	1	2	19	13	2	714	18	2

DRY MEASURE.—*See Table* XII.

(41.) Ch.	b.	p.	(42.) Ch.	qr.	b.	(43.) Qr.	b.	p.	(44.) Score.	ch.	b.
14	31	3	174	3	7	149	7	3	74	20	35
74	31	2	375	1	6	715	3	2	49	19	33
64	30	1	400	0	5	649	1	3	64	17	35
74	27	2	371	1	4	479	2	1	74	14	10
64	19	2	634	2	3	675	1	3	39	13	9
74	31	1	719	1	2	149	2	1	47	16	3
64	11	1	149	2	1	375	1	2	19	17	4
95	10	2	375	1	3	649	1	3	37	18	34

MEASURE OF TIME.—*See Table* XIII.

(45.) Yrs.	m.	w.	(46.) M.	w.	d.	(47.) Days.	hrs.	min.	(48.) Hrs.	min.	sec.
737	12	3	64	3	6	714	23	59	647	59	59
347	11	2	74	1	5	74	14	54	137	54	54
618	10	1	34	2	3	64	21	55	375	56	56
374	9	2	74	1	4	74	13	53	714	17	19
175	3	1	63	2	1	69	12	14	615	54	54
714	12	3	74	1	2	74	12	19	714	17	13
615	10	1	64	2	1	37	11	17	613	34	56
714	3	1	74	1	3	16	12	19	624	27	39

Promiſcuous

Promiſcuous Examples.

(49.) A is indebted to B 27l. 4s. 10d. to C 108l. 11s. 7¼d. to D 157l. 0s. 6d. to E 957l. 11s. 10d. to F 149l. 11s. 10d. to G 190l. 10s. 6d. and to H 900l. 5s. 4d. what is A's whole debt? Anſwer 2490l. 16s. 5¼d.

(50.) A Corn-factor has paid for wheat 49l. 11s. 10d. for rye 47l. 13s. 7d. for oats 104l. 19s. 10d. for barley 77l. 11s. 3d. for peas 88l. 11s. 9d. he has alſo paid for carriage and other incidental charges 5l. 11s. 1½d. for an inſurance 12 guineas; his commiſſion on the whole amounts to 10 guineas; for what ſum muſt he draw upon his employer to clear the account? Anſwer 397l. 1s. 4¼d.

(51.) R of Rotterdam is debtor to H of Hull for fifty firkins of butter, 75 guineas; for 15 pieces of Yorkſhire cloth, 215l. 11s. 10d. for 24 fother of Derbyſhire lead 557l. 11s. 9d. for cheeſe 65l. 11s. 4d. for bar iron 100l. 19s. 7d. for his acceptance of a bill drawn for 571l. 11s. 9d. H has alſo paid convoys, inſurances, port-charges, &c. 27l. 11s. for warehouſe-room, cartage, &c. 7l. 7s. the factorage of the whole amounts to 100 guineas. For what ſterling money muſt H draw upon R to clear this account? Anſwer 1729l. 19s. 3d.

(52.) A collector of caſh has been out with bills, and gives account that A paid him 50 guineas, B 14l. 11s. 6d. C 37l. D 315 quarter-guineas, E a 50l. bank-note, and F 300 guineas. What money had he in charge? Anſwer 551l. 15s. 3d.

(53.) A nobleman, going out of town, is informed by his ſteward that his butcher's bill comes to 194l. 17s. his baker's to 49l. 11s. 6d. his brewer's to 95 guineas, his wine-merchant's to 107l. 11s. 3d. his corn-chandler's to 75l. his tallow-chandler's to 27l. 11s. 6d. his cheeſemonger's to 35 guineas; to his cabinet-maker are owing 315 guineas, alſo for rent, ſervant's wages, &c. he is indebted 140l. 11s. 6d. and if he takes 100 guineas with him to defray his expences on the road, for what ſum muſt he ſend to his banker to ſatisfy theſe demands? Anſwer 1167l. 7s. 9d.

(54.) A gentleman bought of a ſilverſmith diſhes to the weight of 16lb. 11oz. 14dwt. plates 42lb. 10oz, 9dwt. ſpoons 14lb. ſalts 12lb. 9oz. waiters 11lb. 5oz. 10dwt. tankards 11lb. 10oz. and a ſilver tea-board, and other

articles, to the weight of 14lb. 11 oz. 10 dwt. What weight of plate did he buy in all? Anſwer 124lb. 10oz. 3 dwt.

(55.) A merchant in London bought of a farmer in Kent eight bags of hops, No. 1 weighed 3cwt. 2qr. 14lb. No. 2, 2cwt. 1qr. 14lb. No. 3, 4cwt. 1qr. 27lb. No. 4, 2cwt. 3qrs. No. 5, 4cwt. 1qr. 11½lb. No. 6, 6cwt. 1qr. 11lb. No. 7, 7cwt. 1qr. 11¾lb. and No. 8 weighed 5cwt. 3qr. 12lb. the merchant by agreement was to pay the carriage to town, how many cwt. had he to pay for? Anſwer 37 cwt. 0qr. 17¼lb.

(56.) I bought ſix parcels of cloth, the firſt contained 37yds. 1qr. the ſecond 54yds. 3qrs. 2n. the third 15yds. 1qr. 2n. the fourth 72yds. 2qrs. 1n. the fifth 25½yds. and the ſixth 49¾yds. How many yards did I buy in all? Anſwer 255yds. 1qr. 1n.

(§9.) COMPOUND SUBTRACTION.

Definition. *Compound Subtraction* teaches us to find the difference of any two numbers of different denominations.

RULE.

Place the leſs number under the greater, ſo that thoſe parts, which are of the ſame denomination, may ſtand directly under each other. Begin at the loweſt denomination, and ſubtract the under number from the upper: when any of the lower denominations are greater than the upper, increaſe the upper number by as many as make one of the next ſuperior denomination, from which ſum take the figure in the lower line; ſet down the difference, and carry 1 to the next number in the lower line, and ſubtract as before; and ſo on till you have gone through all the denominations.

The method of proof is the ſame as in Simple Subtraction.

MONEY.—*See Table* I.

(1.)

	l.	s.	d.
Borrowed	1749	11	9¼
Paid -	948	12	11¾
Remains to pay	800	18	9½
Proof	1749	11	9¼

(2.)

	l.	s.	d.
Lent	4749	11	10½
Received	1494	11	10¾
Due			
Proof			

(3.)

l.	s.	d.
149	11	4¼
74	10	7¾

(4.)

l.	s.	d.
647	10	7¼
149	19	11¾

(5.)

l.	s.	d.
44	11	8¾
17	14	7½

(6.)

l.	s.	d.
75	11	10¾
44	19	11¾

(7.)

l.	s.	d.
74	11	9¼
39	17	11¾

(8.)

l.	s.	d.
747	11	9¾
714	18	8½

(9.)

l.	s.	d.
719	11	9¼
614	10	8¾

(10.)

l.	s.	d.
613	11	7¾
149	10	4¾

(11.)

	l.	s.	d.
Borrowed	71747	11	10½
Paid at different times	7149	11	4
	675	14	7¾
	714	19	10¼
	147	11	9
	56	19	10¼
	714	11	11¼
	64	18	10¼
Paid in all			
Remains to pay			

(12.)

	l.	s.	d.
Received	71437	11	9¼
Laid out at sundry times	6174	19	10
	734	17	5¾
	615	19	11¾
	375	14	10¼
	74	13	6
	19	18	11¾
	77	14	10½
Laid out in all			
Remains in hand			

(13.) Required the Balance of this Account.

Dr. l.	s.	d.	Cr. l.	s.	d.
747	11	10	41	11	10
314	11	9½	74	13	9¼
647	19	10¼	64	11	6¾
374	14	7	77	13	10¼
167	15	9¼	14	15	9
317	11	8	64	15	10
			37	12	4¾

(14.) Required the Balance of this Account.

Dr. l.	s.	d.	Cr. l.	s.	d.
34	11	9¾	711	10	4
75	19	11	375	13	10¾
67	14	10½	714	19	11¾
47	15	11¾	635	17	10¼
14	19	10	375	14	7
37	15	11¼	14	11	6¼
64	22	10¼			

TROY WEIGHT.—*See Table* II.

(15.) lb.	oz.	dwt.	(16.) oz.	dwt.	gr.	(17.) lb.	oz.	dwt.	(18.) oz.	dwt.	gr.
14	11	9	74	12	13	175	3	10	17	10	20
11	10	14	64	14	17	159	11	14	14	11	23

APOTHECARIES WEIGHT.—*See Table* III.

(19.) lb.	oz.	dr.	(20.) oz.	dr.	scr.	(21.) dr.	scr.	qr.	(22.) lb.	oz.	dr.
144	10	5	27	4	1	27	1	14	74	10	5
64	11	7	14	7	2	14	0	19	65	11	6

AVOIRDUPOIS WEIGHT.—*See Table* IV.

(23.) T.	cwt.	qr.	(24.) Cwt.	qr.	lb.	(25.) Qr.	lb.	oz.	(26.) lb.	oz.	dr.
14	12	2	17	1	25	143	22	12	174	11	10
1	14	3	14	2	27	74	19	14	39	12	13

CLOTH MEASURE.—*See Table* V.

(27.) Yds.	qr.	n.	(28.) E.E.	qr.	n.	(29.) E.Fr.	qr.	n.	(30.) E.Fl.	qr.	n.
174	2	1	174	3	1	171	1	3	12	1	1
39	3	2	49	4	2	74	5	2	10	2	3

LONG MEASURE.—*See Table* VI.

(31.) Lea.	m.	f.	(32.) F.	p.	yd.	(33.) P.	yd.	ft.	(34.) Ft.	in.	b.c.
21	2	4	14	34	4¾	14	3¾	1	17	11	2
3	2	6	12	39	5¼	9	4½	2	14	11	1

SQUARE

SQUARE MEASURE.—*See Table* VII.

(35.) A.	r.	p.	(36.) A.	r.	p.	(37.) A.	r.	p.	(38.) A.	r.	p.
12	1	32	112	1	31	12	1	25	19	1	20
1	3	14	74	2	37	10	3	39	14	2	21

WINE MEASURE.—*See Table* IX.

(39.) T.	hhd.	g.	(40.) Punch.	g.	qt.	(41.) Tier.	g.	qt.	(42.) Gall.	qt.	pt.
27	2	54	147	14	2	14	1	2	24	2	1
19	3	62	79	83	3	12	41	3	17	3	1

ALE AND BEER MEASURE.—*See Table* X.

(43.) A.B.	f.	g.	(44.) B.B.	fir.	g.	(45.) A.hhd.	g.	qt.	(46.) B.hhd.	g.	qt.
14	3	5	147	1	3	271	1	2	143	1	2
12	3	7	39	3	8	49	47	3	79	52	3

DRY MEASURE.—*See Table* XII.

(47.) Ch.	b.	p.	(48.) Ch.	qr.	b.	(49.) Qr.	b.	p.	(50.) Score.	ch.	b.
74	31	3	17	3	1	147	6	2	47	1	12
74	31	2	14	3	7	94	7	3	14	20	35

MEASURE OF TIME.—*See Table* XIII.

(51.) Yr.	m.	w.	(52.) M.	w.	d.	(53.) D.	hrs.	min.	(54.) Hrs.	min.	sec.
17	11	2	147	2	3	167	21	50	174	50	51
14	12	3	19	2	4	19	23	54	94	59	57

Promiſcuous

Promiſcuous Examples.

(55.) A horſe in his furniture is worth 52l. 10s. out of it 24l. 10. 6d. how much does the price of the furniture exceed that of the horſe? Anſwer 3l. 9s.

(56.) What ſum added to 11l. 14s. 9¼d. will make 133l. 11s. 9½d? Anſwer 121l. 17s. 0¼d.

(57.) A Tradeſman, failing, was indebted to A 105l. 19s. 11d. to B 150 guineas; to C 34l. 18s. 10d. to D 500l. 19s. to E 700l. 14s. 9d. When this happened, he had caſh by him to the amount of 50l.; goods to the amount of 350l. 14s. 9d. his houſehold furniture was worth 24l 11s. his book-debts amounted to 94l. 14s. 8d.—If theſe things were faithfully given up to his creditors, what did they loſe him? Anſwer 980l. 2s. 1d.

(§ 10.) COMPOUND MULTIPLICATION.

Definition. *Compound Multiplication* is a rule by which we find the amount of any given number, of different denominations, by repeating it any propoſed number of times.

Propoſition 1. *When the Multiplier does not exceed* 12.

Rule. Multiply the loweſt denomination by it, divide the product by the number making one of the next higher denomination; ſet down the remainder, and carry the quotient to the product of the next higher denomination: proceed thus till all the denominations are multiplied.

(1.) What coſt 4 yards of cloth at 7s. 6½d. per yard?

7 6½
4

£1 10 2 Anſwer.

(2) 5 Buſhels at 5s 10d—Anſwer 1l 9s 2d

(3) 6 Yards at 6s 9d.—Anſ. 2l 0s 6d

(4) 7 Ells at 5s 11½d.—Anſ. 2l 1s 8½d

(5) 8 Oz. at 7s 10d.—Anſ. 3l 2s 8d.

(6) 9 lb. at 7s 5¼d.—Anſ. 3l 6s 11d¼.

(7) 10 Gallons at 16s 4½d.—Anſ. 8l 3s 9d.

(8) 11 cwt. at 1l 9s 10½.—Anſ. 16 8s 7½.

(9) 12 Sheep at 1l 17s 9d.—Anſ. 22l 13s.

(10) In 9 pieces of kerſey, each 14yds 3qrs 2n. how many yards? Anſwer 133 yds. 3qrs. 2n.

(11) What

(11) What is the weight of 12 tankards, each weighing 11oz. 10dwt. 19gr? Anſwer 138 oz. 9dwt. 12 gr.

* (12) In 11 pieces of cloth, each 17yds. 3qrs. 3 n. how many yards? Anſwer 197 yds. 1 qr. 1n.

Prop. 2. *If the Multiplier exceeds* 12, *and is a compoſite Number.*

Rule. Multiply ſucceſſively by the component parts inſtead of the whole number at once.

(13) What coſt 15 gallons of wine, at 5s. 3½d. per gallon?

		5		5×3=15
1	6	5½	price of 5.	
		3		
£3	19	4½	price of 15. Anſ.	

(14) 16 Hogſheads at 3l 14s 5d.—Anſ. 59l 10 8d.

(15) 24 Yards at 7s 5d½.—Anſ. 8l 19s.

(16) 35 cwt. at 1l 14 8½d.—Anſ. 60 14s 9d½.

(17) 36 Tons at 5l 15s 11d¼. Anſ. 208l 13 19.

(18) 84 Chaldrons at 1l 16s 9¾d.—Anſ. 154l 12s 3d.

(19) 108 Buſhels at 7s 9½d.—Anſ. 42l 1s 6d.

(20) 132 Ells at 18s 9¼d.—Anſ. 123l 17s 9d.

(21) 144 Butts at 5l 13s 9½d.—Anſ. 819l 6s.

(22) In 32 wedges of gold, each 2lb. 7oz. 14gr. how many pounds? Anſwer 82lb. 8oz. 18 dwts. 16 grs.

(23) In 21 fields, each 3a. 2r. 19p. how many acres? Anſwer 75a. 3r. 39p.

Prop. 3. *When the Multiplier cannot be produced by the multiplication of two, or more, ſmall numbers.*

Rule. Find two, or more, numbers that compoſe the *neareſt* number to the Multiplier; then multiply by the component parts as before, and add, or ſubtract, the odd parts as you find occaſion.

(24) What coſt 23 yards of cloth at 14s. 9d. per yard?

s.	d.			
14	9	7×3+2=23.	Or thus 14	9 6×4−1=23.
	7			
5	3	3 price of 7.	4	8 6 price of 6.
		3		4
15	9	9 price of 21.	17	14 0 price of 24.
Add 1	9	6 price of 2.	Subtract	14 9 price of 1.
16	19	3 price of 23.	16	19 3 price of 23.

(25) 31

(25) 31 Yards at 12s $7\frac{1}{4}$d.—Anſ. 19l 10s $8\frac{3}{4}$d.
(26) 39 Dozen at 6s $7\frac{1}{2}$d.—Anſ. 12l 18s $4\frac{1}{2}$d.
(27) 139 Pair at 4s $9\frac{1}{4}$.—Anſ. 33l 3s $1\frac{3}{4}$d.
(28) 86 lb. of ſilk at 19s 4d.—Anſ. 83l 2s 8d.
(29) 111 Sacks of flour at 11 4s 9d.—Anſ. 137l 7s 3d.
(30) 156 Cwt. at 4l 9s 6d.—Anſ. 698l 2s.
(31) In 57 years, each 13m. 1d. 6hrs. how many months? Anſwer 743 m. 15ds. 6 hrs.
(32) What is the weight of 29 hhds. of ſugar, each 7cwt. 2qr. 18lb? Anſwer 222 cwt. 18lb.
(33) In 67 parcels of tea, each 25 lb. 7oz. 13drs. how many cwts. &c.? Anſwer 15 cwt. 27lb. 11oz. 7drs.

Prop. 4. *If the Multiplier be four, five, or more, hundreds.*

Rule. Multiply the given price, or quantity, by 10, and that product by 10, and ſo on for 10, 100, or 1000 times the price or quantity: then multiply each product by the number of thouſands, hundreds, and tens, and the firſt line by as many as make up the number of things, or multiplier, and the ſum of the products will be the anſwer.

(34) What coſt 394 yards at

	s.	d.	
	17	$5\frac{1}{2}$	per yard
		10	
9×	8	14 7	price of 10
		10	
	87	5 10	price of 100
		3	
	261	17 6	price of 300
	78	11 3	price of 90
	3	9 10	price of 4
	343	18 7	price of 394

(35) 357 Oxen at 7l 10s 5d. Anſ. 2684l 18 19.
(36) 549 Sheep at 12s $9\frac{1}{2}$d. Anſ. 351l 2s $7\frac{1}{2}$.
(37) 754 lb. of Tea at 6s 10. Anſ. 257l 12s 4d.
(38) 198 lb. of Indigo at 6s $3\frac{1}{4}$d.—Anſ. 62l 1s $7\frac{1}{2}$d.
(39) 754 Fother at 20l 5s 10d. Anſ. 15299l 18s 4d.
(40) 178 Ells at 5s $9\frac{1}{4}$d.—Anſ. 51l 7s $2\frac{1}{2}$d.
(41) 198 Barrels at 1l 14s 9d. Anſ. 344l 0s 6d.
(42) 744 Chaldron at 1l 16s 8d.—Anſ. 1364l.

Prop. 5. *If the Multiplier be a whole number with parts annexed.*

Rule. When you have multiplied by the whole number, for $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, or $\frac{1}{6}$, &c. divide the top-line by 2, 3, 4, 5, or 6, &c. but, if the numerator of the fractional part be

be greater than 1, multiply the top-line by it, and divide the product by the denominator; add this quotient to the product, or value, obtained by multiplying with the whole number.

Note. The upper figure is called the Numerator, and the lower one the Denominator. Thus $\frac{5}{7}$ *Numerator. Denominator.*

(43) What coſt 56½ Chaldrons at 1 l. 14 s. 9 d. per chaldron.

		7	
12	3	3	price of 7.
		8	
97	6	0	price of 56.
	17	4½	price of ½
£98	3	4½	price of 56½

(44) What coſt 4⅝ yards at 7 s. 6 d. per yard.

				s.	d.
		4			
1	10	0	price of 4.	7	6
	4	2	price of ⅝.		5
£1	14	2	price of 4⅝	9)37	6
				4	2

(45) 1788⅕ Gallons at 6s 4d.—Anſ. 566l 5s 3⅕d.
(46) 3714 ⅛ Cwt. at 4l 11s 9d.—Anſ. 17038l 10s 11½d.
(47) 7149⅗ Chaldrons at 1l 14s 9d.—Anſ. 12422l 2s 7¼d.
(48) 547⅝ Laſts at 5l 5s.—Anſ. 2875l 0s 7½d.
(49) 1749½ Firkins at 14s 9d¼d.—Anſ. 1292l 1s 6¾d.
(50) 754⅗ Cwt. at 17s 5¼d.—Anſ. 658l 0s. 11d¼d.

(§ 11.) COMPOUND DIVISION.

Definition. Compound Diviſion teaches us to find how often one given number is contained in another of different denominations; or, to divide a given compound-number into any propoſed number of equal parts.

RULE.

Place the diviſor to the left hand of the dividend. Divide the higheſt denomination of the dividend by the diviſor, and bring the remainder, if any, into the next inferior denomination, adding thereto the parts of that name in the dividend: divide this number as above, and ſo on till the whole is finiſhed. If the diviſor be large, and not a compoſite number, divide after the manner of long diviſion.

The method of proof is by Compound Multiplication.

(1) A Gentleman's Income is 1260l 15s 5d a year, what is that per day, 365 days being in 1 year?

	l.	s.	d.		l.	s.	d.	
365)	1260	15	5	(	3	9	1	answer.
	1095						10	
	165				34	10	10	× 6
	20						10	
	3315				345	8	4	
	3285						3	
	30				1036	5	0	
	12				207	5	0	
	365				17	5	5	
	365				1260	15	5	proof.

(2) Divide 47l 19s 4d by 3.—Anſ. 15l 19s $9\frac{1}{4}$.—Rem. 1.
(3) Divide 37l 14s 10d by 24.—Anſ. 1l 11s $5\frac{1}{4}$.—16.
(4) Divide 49l 19s $11\frac{1}{2}$d by 66.—Anſ. 15s $1\frac{3}{4}$d.—15.
(5) Divide 34l 14s $9\frac{1}{4}$d by 149. Anſ. 4s. $7\frac{3}{4}$d.—122
(6) Divide 477l 19s $10\frac{3}{4}$d by $7\frac{1}{4}$.—Anſ. 65l 18s $7\frac{1}{4}$.—$\frac{3}{29}$.
(7) Divide 149l 11s $3\frac{1}{4}$ by $3\frac{5}{8}$.—Anſ. 41l 5s 2.—$\frac{4}{29}$.
(8) Divide 1774l 19s $10\frac{1}{4}$ by 179.—Anſ. 9l 18s $3\frac{3}{4}$.—92.
(9) Divide 47yds. 3qr. 2n. by 5.—Anſ. 9yds. 2 qr. 1n.—1.
(10) Divide 375a. 3r. 14p. by 9.—Anſ. 41a. 3r. 1p.—5.
(11) Divide 714lb 10 oz. 12gr. by 89.—Anſ. 8lb. 7dwt. 15gs.—45.
(12) Divide 374cwt. 3qr. 1clb. by 48.—Anſ. 7cwt. 3qr. lb.—30.
(13) Divide 374 Ells E. 2qr. 3n. by 142.—Anſ. 2 Eng. Ells 3qr.—107.
(14) Divide 3149ch. 21b. 3p. by $374\frac{1}{8}$.—Anſ. 8ch. 13b. 1 p.—$\frac{12}{29}\frac{11}{93}$.
(15) Divide 47 oz. 11dwt. 12gr. by $34\frac{5}{7}$.—Anſ. 1 oz. 7dwt. 9gr.—$\frac{201}{243}$.
(16) If 60 ſheep be ſold for 112l 10s. what is the value of 1? Anſwer 1l 17s 6d.
(17) If 112lb. of cheeſe coſt 2l 18s 8d. what is that per lb? Anſwer $6\frac{1}{4}$d $\frac{10}{112}$.
(18) If 17 cwt. of lead coſt 15l 5s $7\frac{3}{4}$d. what coſts 1? Anſwer 17s $11\frac{3}{4}$d.
(19) Bought 7 yards of cloth for 16s 4d. what is that per yard? Anſwer 2s 4d.

(20) If

(20.) If 63 Oxen coſt 493l. 13s. 11¼d. what coſts 1? Anſwer 7l. 16s. 8¾d.

(21.) If 66lb. of Butter coſt 1l. 11s. 7½d. what coſts 1lb? Anſwer 5¾d.

(22.) If 528lb. of Tobacco coſt 23l. 13s. what coſts 1lb? Anſwer 10¾d.

(23.) If a Tun, or 252 Gallons, of Wine, coſt 60l. what coſts 1 Gallon? Anſwer 4s. 9$\frac{1}{7}$d.

(24.) A Prize of 1000 Guineas is to be divided among 150 Sailors, what is each Man's Share after deducting $\frac{1}{6}$ part for the officers? Anſwer 5l. 16s. 8d.

(25.) If 125 Ingots of Silver, each of an equal Weight, weigh 13470z. 11dwt. 14gr. what is the weight of 1 Ingot? Anſwer 10 oz. 15dwt. 4gr. $\frac{88}{125}$.

(26.) If 475cwt. 1qr. 14lb. be the Weight of 27 Hhds of Tobacco, what is the Weight of 1? Anſ. 7cwt. 2qr. 11lb. $\frac{25}{27}$.

(27.) Bought 6½ Pieces of Tapeſtry, containing 237 Ells Flem. 2qr. 2n. what is the Length of 1 Piece? Anſwer 36 Flem. ell 1qr. 3$\frac{1}{13}$n.

BILLS of PARCELS and BOOK DEBTS.

(1.) James Lamb, Eſq.

Bought of John Simpſon, Jan. 1, 1791.

			£
7½lb.	of green Tea,	at 10s. 4d. per lb.	——
14¼	of fineſt Bloom	at 14s. 8d.	——
10¾	of fine Green	at 16s. 5d.	——
21	of Hyſon	at 10s. 10½d.	——
19	of good Hyſon	at 13s. 9½d.	——
8¼	of Bohea	at 6s. 9d.	——
			£ 50 9 1

(2.) Sir John Guchim

Hull, 1791. To S. Jefferſon, Dr.

			£
Jan. 11.	For 37¼ Yds of Sheeting, at 1s. 4½d. per Yard	——	
Feb. 3.	For 43⅜ Yds of Lace, at 4s. 0¾d. per Yard	——	
—— 16.	For 75⅗ Ells of Iriſh, at 2s. 3d. per Ell		
May 12.	— 209 — of Dowlas, at 9¼d.	——	
—— 15.	— 730 — of Muſlin, at 7s. ½d.	——	
			£ 284 18 0¼

Received the Contents,

S. Jefferſon.

*(3.) The Honourable Mrs. Caſtor, Dr.
1791. To Joſiah Gilroy.

July 31.	For a Mahogany Cheſt of Drawers, compleat ——	£	18	11 6
Aug. 3.	1 Doz. of Maho. Chs. at ol. 6s. 10d. ea.			
15.	A Feather Bed and Bol. ——	3	0	0
19.	Four Pair of Blankets, at ol. 18s. od. ea.			
20.	Four quilted Coverlids, at 1l. 9s. od.			
		£	35	1 6

*(4.) Her Grace the Ducheſs of Argyle, Dr.
1791. To Ferdinando Ranger.

Jan. 15.	For 73 Gals of Claret W. at 1l. 1s. 8d. per G.	£.		
18.	For 43 Do. of Mountain, at ol. 6s. 7d.			
Feb. 5.	For 57 Do. of Port red, at ol. 7s. 10d.			
	For 12 Do. of Burgundy, at 1l. 16s. od.			
	For 19 Do. of Champaign, at 1l. 7s. od.			
	For 27 Do. of Madeira, at ol. 7s. 4d.			
	For 29 Do. of White Liſbon, at ol. 6s. 5d.			
		£	182	10 4

*(5.) The Right Hon. Piercy Earl of Northumberland, Dr.
1791. To Peter Arundel and Partner.

Aug. 10.	For a new Poſt Chariot —	£	71	11 6
13.	20 Yds. of green Cloth for the Lining at }	1s. 2d. per Yd		
28.	To 300 Braſs Nails at	4s. 6d. per Hd		
	15 Yds. of Brown Serge for the Box at }	8s. 6d. per Yd		
30.	31 Yds. of laced Ferret at os. 6¼d.			
	To 1 Pair of Harneſs compleat		12	0 0
		£	92	11 11¾

*(6.) Sir Nicholas Bacon, Dr.
To George Manwell, for Work and Materials in his Houſe
1791. at St. Mary le Bone.

July 17.	For 30 Hundred of Lime at ol. 17s. 3d. per Hd.	£		
27.	40 Thouſand of Bricks at 1l. os. od. per Th.			
29.	Work for 13 Men 17 Days at ol. 3s. 6d. per Day.			
Aug. 4.	Do for 13 Labourers Do at ol. 2s. 1d. ——			
15.	11 Thouſand 10 Inch Tiles at ol. os. 3½d. each			
26.	20 Load of Sand at ol. 2s. 6¾d. per Ld.			
		£	290	11 0

(7.)

*(7.) Chriſtopher Henſey, Eſq. Dr.
To Abraham Cronſey.

1791.
Dec. 6. For Oats 10 Quarters at 1s. 10d. per Bſh. £
12. Barley 15 Qrs. at 2s. 8d.
14. Beans 12 Qrs. at 3s. 9d.
18. Peas 9 Qrs. at 3s. 5d.
20. Hops 28 Pounds at 3s. 10d. per lb.
30. Malt 10 Qrs. at 1s. 3d. per Bſh.

£ 64 0 0

*(8.) Mr. Paul Dandridge, Dr.
To Jonathan Carpenter and Partner.

1791.
Sept. 4. For 21 Feet of Fir Timber at 0s. 3½d. per F. £
11. 13 Whole Deals at 1s. 9d. each
17. 15 Slit Deals at 0s. 10½d. ——
19. 26 Hundred of Nails at 0s. 6d. per Hd.
Oct. 2. 17 Hundred of Nails at 0s. 10d. ——
15. 26 Days Work at 2s. 6d. per Day.

£ 6 14 2

*(9.) Mr. Benjamin Davies, Dr.
To Simon Matthewſon, Dyer.
For Dying the following Goods, delivered per Order, to
Giles Penn, Packer.

1791.
May 12. Yellow Stuffs 50 Ps. at 13s. 9d. per Piece
Aug. 6. Blue Do. 80 at 12s. 3d.
Nov. 23. Black Do. 20 at 11s. 9d.
29. White Do. 70 at 8s. 10d.
Dec. 24. Orange Do. 40 at 14s. 7d.
30. Green Do. 29 at 8s. 8d.

£ 167 15 6

(10.) George Veres, Eſq. IV.
Bought of Charles Weſt,

London, December 8, 1791.
A Loin of Lamb, Weight 7¼lb. at 10¾d. per lb. £
A Fillet of Veal, Weight 16¾lb. at 6½d. ——
A Buttock of Beef, Wt. 37½lb. at 4½d. ——
A Pig, — Weight 12¾lb. at 7¼d. ——
A Leg of Pork, Weight 16¼lb. at 5½d. ——
A Leg of Mutton, Weight 13¾lb. at 4¾d. ——

£ 2 10 2

(11.) Hugh Abbot V.

Bought of C. Hartley,

London, Aug. 18, 1791.

174⅜ lb. of Quinquina,	at	3l. 14s.	8d.	per lb. £
321⅗ lb. of Gum Lac,	at	5s.	9d.	——
607⅛ lb. of Rhubarb,	at	12.	4d.	——
720½ lb. of Maſtich,	at	1s.	0¾d.	——
509⅕ lb. of Saſſafras,	at		6½d.	——

£ 1170 17 0¾

Received at the ſame Time the Contents,

C. Hartley.

(12.) Miſs Evitt, VI.

Bought of William Wilſon,

London, Sept. 22, 1791.

19¼ Yards of Flanders Lace,	at	9s. 8d.	per Yard £
27⅝ —— of Dreſden Lace,	at	15s.	5½d. ——
113⅜ —— of Gauze,	at	2s.	2¾d. ——
215¼ —— of Muſlin,	at	7s.	5¾d. ——
25⅔ Dozen of Napkins,	at	27s.	6d. per Doz.
118 Pair of Kid-Gloves,	at	1s.	8¾d. per Pair

£ 169 10 5¼

(13.) Mr. Crowther, VII.

Bought of Caroline Cockayne,

London, October 5, 1791.

114 Yards of Muſlin,	at	8s.	4⅓d.	per Yard £
17⅗ —— of Holland,	at	4s.	6d.	——
715½ —— of Cambric,	at	10s.	7d.	——
126¼ Ells of Dowlas,	at	1s.	2½d.	per Ell
271¼ —— of Iriſh,	at	2s.	9½d.	——
419¾ —— of Chints,	at	5s.	10d.	——

£ 59 5 0½

Received at the ſame Time the Contents.

Caroline Cockayne.

(§ 12.) REDUCTION.

Definition. *Reduction* is the Method of reducing Numbers from one Name or Denomination, to another of the ſame Value.

RULE.

All great Names are brought into ſmall by multiplying with as many of the next leſs as make one of the greater, adding to the Product the Parts of the leſs Name, if the Number to be reduced be a Compound one: and all ſmall Names are brought into great by dividing with as many of the leſs as make one of the next greater.

The Method of Proof is by reverſing the Queſtion.

I. MONEY.—*See Table I.*

(1.) In 5l. 5s. how many ſhillings, pence, and farthings?

5l. 5s.
20
105 ſhillings.
12
1260 pence.
4
5040 farthings.

Here is a great name brought into a ſmall.

(2.) In 4800 farthings how many pence, ſhillings, and pounds?

4)4800 farthings.
12)1200 pence.
20)100 ſhillings.
5 pounds.

Here a ſmall name is brought into a great, by a method of operation directly the converſe of the preceding.

(3.) In 19 Pounds, how many Shillings, Pence, and Farthings?—Anſ. 380s. 4560d. 18240f.

(4.) In 55 Guineas, how many Shillings, Pence, and Farthings?—Anſ. 1155s. 13860d. 55440f.

(5.) Reduce 54l. 11s. 9¼d. into Farthings.—Anſ. 52400f.

(6.) Reduce 77l. 11s. 10½d. into Halfpence.—Anſ. 37245 Halfpence.

(7.) Reduce 94l. 14s. 8d. into Pence.—Anſ. 22736d.

(8.) Reduce 47. 14s. 4d. into Two-penees.—Anſ. 5726 Two-pences.

(9.) In 34l. 11s. 9d. how many Three-pences and Pence?—Anſ. 2767 Three-pences, 8301d.

(10.) In 47l. 19s. 8d. how many Groats, Pence, and Farthings?—Anſ. 2879 Groats, 11516d. 46064f.

(11.) In 1081. 11s. 6d. how many Six-pences.—Anſ. 4343 Six-pences.

(12.) How many Crowns, Half Crowns, Shillings, Six-pences, and Pence, are in £ 54?—Anſw. 216 crowns, 432 half crowns, 1080 ſhillings, 2160 ſixpences, 12960 pence.

(13.) Reduce 74l. 13s. 9d. into Shillings, Three-pences, and Farthings.—Anſ. 1493 ſhil. 5975 three-p. 71700 farth.

(14.) In 11520 Farthings, how many Pence, Shillings, and Pounds?—Anſ. 2880d. 240s. 12l.

(15.) In 17880 Pence how many Pounds.—Anſ. 74l. 10s.

(16.) Reduce 100800 Farthings into Guineas.—Anſ. 100 guineas.

(17.) In 50400 Halfpence how many Pounds?—Anſ. 105l.

(18.) In 12050 Shillings, how many Crowns and Pounds?—Anſ. 2410cr. 602l. 10s.

(19.) Reduce 311040 Pence into Groats, Shillings, Crowns, and Pounds.—Anſ. 77760gr. 25920s. 5184cr. 1296l.

(20.) In 102l. 16s. 3d. how many Pieces of Coin, each 7s. 3½d. in Value?—Anſ. 282.

*(21.) In 400 Moidores, how many Pounds?—Anſ. 540l.

*(22.) In 59892 Farthings, how many Three-pences, Shillings, and Pounds?—Anſ. 4991 three-p. 1247s. and 62l. 7s. 9d.

2. TROY WEIGHT.—*See Table* II.

(23.) In 17lb. 5oz. how many Grains?—Anſ. 100320.

(24.) In 6720 Grains how many Ounces?—Anſ. 14ozs

(25.) In 14 Ingots of Silver, each 27oz. 10dwt. how many Grains?—Anſw. 184800gr.

(26.) In 474 Spoons, each weighing 3 oz. 10dwt. how many Pounds of Silver?—Anſ. 138¼lb.

(27.) How many Pints, each 9oz. may be made out of 17l. 6oz. 14dwt. of Silver?—Anſ. 23 pints, and 3oz. 14dwt. over.

(28.) A Gentleman ſent a Tankard to his Goldſmith weighing 50oz. 8dwt. and ordered him to make it into Tea-ſpoons, each weighing 1⅕oz. how many had he?—Anſ. 42 tea-ſpoons.

3. APOTHECARIES WEIGHT.—*See Table* III.

(29.) In 25lb. how many Scruples and Grains?—Anſ. 7200 ſcruples, 144000grs.

(30.) In

(30.) In 97920 Grains, how many Ounces and Pounds? —Anſ. 204oz. 17lb.

(31.) In 15lb. 1 oz. 1 dram, 1 ſcruple, 2gr. how many Grains? 86962gr.

(32.) In 174947 Grains how many Pounds?—Anſ. 30lb. 4oz. 3 drams, 2 ſcruples, 7gr.

(33.) An Apothecary made a Compound of 12oz. 1 dram, 2 ſcruples, 14gr. into Troches of 1 ſcruple, of 1⅓ ſcruple, and of 14gr. and into Pills of 11gr. and 13gr. each; he made an equal Number of Troches and Pills, how many of each had he?—Anſ. 69 of each and 32gr. over.

4. AVOIRDUPOIS WEIGHT.—*See Table* IV.

(34.) In 12 Tons of Iron how many Pounds?—Anſ. 26880lb.

(35.) In 31360 Pounds of Iron how many Tons?—Anſ. 14 tons.

(36.) In 375cwt. 2qr. 15lb. of Copper how many Pounds? —Anſ. 42071lb.

(37.) Reduce 740900 Ounces into Hundred Weights and Tons.—Anſ. 20t. 13cwt. 1qr. 22lb. 4oz.

(38.) In 39 Bags of Hops, each 3cwt. 1qr. 14lb. how many cwts.—Anſ. 131cwt. 2qr. 14lb.

(39.) In 750 Fother of Lead, each 19½cwt. how many cwts.?—Anſ. 14625cwt.

(40.) In 135cwt. of Raiſins how many Parcels, each 90lb.? —Anſ. 168 Parcels.

(41.) In 570 great Pounds of Silk how many common? —Anſ. 855 common lbs.

(42.) In 525 common Pounds of Silk how many great? —Anſ. 350 great lbs.

(43.) How many Pounds in 54 Hhds. of Tobacco, each weighing 17½cwt.—Anſ. 105840lb.

(44.) A Grocer weighed out a Hhd. of Sugar, containing 16cwt. 3qr. 10lb. into Parcels of 6lb. of 8lb. of 12lb. of 14lb. and of 28lb. and had an equal Number of each; how many of each had he?—Anſ. 27$\frac{10}{63}$.

5. CLOTH MEASURE.—*See Table* V.

(45.) In 314 Yards how many Nails?—Anſ. 502z4n.

(46.) In 576 French Ells how many Yards?—Anſ. 864yds.

(47.) Re-

(47.) Reduce 97yds. 3qrs. into Engliſh Ells.—Anſ. 78$\frac{1}{5}$ells.

(48.) In 57 Pieces of Holland, each 35 Ells Flemiſh, how many Nails?—Anſ. 23940 nails.

(49.) In 14 Bales of Cloth, each 17 Pieces, each Piece 56 Ells Flemiſh, how many Yards?—Anſ. 9996yds.

(50.) In 394 Pieces of Stuff, each 23$\frac{1}{4}$ Yards, how many Yards?—Anſ. 9160$\frac{1}{2}$yds.

(51.) In 796 Pieces of Kerſey, each 45$\frac{7}{8}$ Yards, how many Yards?—Anſ. 36516$\frac{1}{2}$yds.

6. LONG MEASURE.—*See Table* VI.

(52.) In 471 Miles how many Furlongs and Poles?—Anſ. 3768f. 150720p.

(53.) In 123200 Yards how many Miles?—Anſ. 70m.

(54.) In 50 Miles how many Yards, Feet, Inches, and Barley-corns?—Anſ. 88000yds. 264000ft. 3168000inch. 9504000bc.

(55.) Reduce 37m. 2fur. 37p. 5f. 6in. into Feet.—Anſ. 197296feet.

(56.) In 17400 Chains how many Furlongs and Miles?—Anſ. 1740f. 217$\frac{1}{2}$ miles.

(57.) How many Barley-corns will reach round the Earth, which is 360 Degrees, each 69$\frac{1}{2}$ Miles? Anſ.—4755801600 bc.

(58.) How often will a Perambulator, 2$\frac{3}{4}$ Yards in Circumference, turn between London and York, being 198 Miles?—Anſw. 126720 times.

7. LAND MEASURE.—*See Table* VII.

(59.) In 77a. 1r. 14p. how many Perches?—Anſ. 12374p.

(60.) In 17280 Perches how many Acres?—Anſ. 108a.

(61.) If a Piece of Ground, containing 14a. 34p. be taken from a Field of 50 Acres, how many Perches will the Remainder contain?—Anſ. 5726 Perches.

(62.) A Gentleman has 4 Fields, the firſt meaſures 3a. 1r. the ſecond 4$\frac{1}{2}$ Acres, the third 5a. 30 perch. and the fourth 4a. 3r. 20p. and theſe he wiſhes to divide into Parcels, or Shares, of 3$\frac{3}{4}$ Roods each, for the Purpoſe of accommodating his manufacturing Tenants with ſmall Tenements; how many will he have?—Anſ. 19 Tenements.

8. WINE

8. WINE MEASURE.—*See Table* IX.

(63.) Reduce 32 Hhds. into Quarts.—Anſ. 8064 qts.
(64.) In 3276 Gallons how many Tuns?—Anſ. 13 t.
(65.) How many Gallons and Pints are in 75 Hhds.?—Anſ. 4725 gal. 37800 pts.
(66.) In 77 Hhds. of Brandy how many ½ Anchors?—Anſ. 970⅓ anchors.
(67.) In 10 Tuns, 2 Hhds. 18 Gallons of Wine how many Pipes, Puncheons, Hhds. Tierces, and Runlets, and of each an equal Number?—Anſ. 8 of each.

9. ALE AND BEER MEASURE.—*See Tables* X. *and* XI.

(68.) In 38 Hogſheads of Ale, in London, how many Pints?—Anſ. 14592 pints.
(69.) In 38 Hogſheads of Ale, in the Country, how many Pints?—Anſ. 15504 pints.
(70.) Reduce 516 Barrels of Beer, London Meaſure, into Half-pints.—Anſ. 297216 half-pints.
(71.) How many Gallons of Beer are contained in a Back of 50 Barrels, Country Meaſure?—Anſ. 1700 gallons.

10. DRY MEASURE.—*See Table* XII.

(72.) In 44 Quarters of Corn how many Pecks?—Anſ. 1408 pecks.
(73.) In 30720 Quarts how many Laſts?—Anſ. 12 laſts.
(74.) In 50 Chaldrons of Coals how many Pecks.—Anſ. 7200 pecks.
(75.) How many Sacks, of 3 Buſhels each, are contained in 193 Chal. 12 Buſh. of Coals?—Anſ. 2320 ſacks.

11. MEASURE OF TIME.—*See Table* XIII.

(76.) In 365d. 5h. 48m. 55ſec. being a ſolar Year, how many Seconds?—Anſ. 31556935 ſeconds.
(77.) In 354d. 8h. 48m. 36½ſec. being a lunar Year, or 12 lunar Months, how many Seconds?—Anſ. 30617316½ ſeconds.

(78.) How

(78.) How many Days, Hours, Minutes, and Seconds, have elapſed from the Creation of the World to Chriſtmas 1792, ſuppoſing the Creation to have been 4004 Years before the Incarnation of Chriſt?—Anſ. 2116989 days, 50807736 hours, 3048464160 min. 182907849600 ſec.

(79.) If London was built 1108 Years before Chriſt's Nativity, how many hours is it ſince to Chriſtmas 1792?—Anſ. 25421400o hours.

(80.) From May 18, 1791, to February 18, 1818, how many Days?—Anſ. 9772½ days.

(§ 13.) DIRECT PROPORTION,

OR

THE RULE OF THREE.

Definition. Direct Proportion teaches, by three given Numbers, to find a fourth, in ſuch Proportion to the third as the ſecond is to the firſt.

RULE.

State the Queſtion by placing the Numbers in ſuch Order that the firſt and third may be of one Kind, and the ſecond the ſame as the Number required; then, bring the firſt and third Numbers into one Name, and the ſecond into the loweſt Denomination mentioned. Multiply the ſecond and third Numbers together, divide the Product by the firſt, and the Quotient will be the Anſwer in the ſame Denomination as the ſecond Number.

The Method of Proof is by changing the Order of the Stating.

(1.) If 2cwt. 3qr. 14lb. of Sugar coſt 6l. 14s. 2d. what will 12cwt. 3qrs. coſt.

Firſt

First number.	2d number.	3d number.
If 2cwt. 3qr. 14lb.	: 6l. 14s. 2d.	:: 12cwt. 3qr.
4	20	4
11 qr.	134 ſhillings	51 qr.
28	12	28
322 lb.	1610 pence.	408
		102
		1428 lb.
		1610
		14280
		8568
		1428
		12)
		322)2299080(7140 pence, fourth
Anſwer 29l. 15s.		2254 2|0)59|5 ſhill.(numb.
		450 £ 29 15
		322
		1288
		1288
		...0

(2.) If 12cwt. 3qr. of Sugar be bought for 29l. 15s. what will 2cwt. 3qr. 14lb. coſt?—Anſ. 6l. 14s. 2d.

(3.) If 6l. 14s. 2d. be paid for 2cwt. 3qr. 14lb. of Sugar what Quantity may be bought for 29l. 15s.—Anſ. 12cwt. 3qr.

(4.) If 29l. 15s. will buy 12cwt. 3qr. of Sugar, what Quantity will 6l. 14s. 2d. buy?—Anſ. 2cwt. 3qr. 14lb.

(5.) If a Cwt. of Tobacco be worth 9l. 16s. what is the Worth of 1lb?—Anſ. 1s. 9d.

(6.) If 1lb. of Butter coſt $5\frac{3}{4}$d. what will a Firkin, or 56lb. coſt?—Anſ. 1l. 6s. 10d.

(7.) Bought $3\frac{1}{2}$ Yards of Cloth for 2l. 16s. 3d. what muſt I give for $28\frac{3}{4}$ Yards at the ſame Rate?—Anſ. 23l. 2s. $0\frac{1}{2}$d. $\frac{4}{7}$

(8.) If I buy 56 Yards of Cloth for 40 Guineas, how many Ells Flemiſh can I buy for 1135l. 10s.?—Anſ. 2018 Flem. e. 2qr.

(9.) A Sailor entered on board a Man of War the 14th of May, 1780, and was diſcharged the 11th of December, 1783, what came his Wages to at 1l. 5s. per Month?—Anſ. 58l. 6s. $0\frac{3}{4}$d. $\frac{3}{7}$

(10.) How

(10.) How long will a Perſon be ſaving 100l. if he lays by 1s. 6d. a Week?—Anſ. 25yrs. 8m. $1\frac{1}{3}$wk.

(11.) Bought 55 Yards of Holland for 11l. 5s. how many Engliſh Ells can I buy for 100 Guineas at the ſame Rate? Anſ. 410 Eng. ells, $3\frac{1}{3}$qr.

(12.) A Factor bought 30 Quarters of Corn for 76l. 17s. 6d. and 150 Quarters of an inferior Kind for 361l. 11s. 8d. to mix with it; how muſt he ſell the Mixture per Buſhel to gain 20l. by the Bargain?—Anſ. 6s. $4\frac{1}{4}$d.$\frac{2}{3}\frac{3}{8}$

(13.) Bought 27 Pieces of Cloth, each 34 Ells, at 7s. 6d. per Ell, what is the Value of the Whole?—Anſ. 344l. 5s.

(14.) A Creditor agrees to receive of his inſolvent Debtor after the Rate of 10s. 6d. in a Pound for a Debt of 475l. 10s. how much will he receive in the Whole?—Anſ. 249l. 12s. 9d.

(15.) If 18l. 14s. $9\frac{3}{4}$d. were paid for the Carriage of 53cwt. 2qr. 5lb. what was paid for the Carriage of 1lb,?—Anſ. $0\frac{3}{4}$d.

(16.) A Bankrupt's Effects amount to $1000\frac{1}{2}$ Guineas. His Debts amount to 2547l. 14s. 9d. what will his Creditors receive in the Pound?—Anſ. 8s. $2\frac{3}{4}$d. $\frac{1}{2}\frac{7}{0}\frac{1}{3}\frac{8}{8}\frac{1}{1}\frac{5}{9}$

(17.) The Rental of a Village is 4714l. 11s. 10d. A Tax of 117l. 17s. $3\frac{1}{2}$d. is to be made for the Support of the Poor; at what Rate per Pound muſt the Aſſeſſment be made to defray the Expences?—Anſ. $5\frac{3}{4}$d. $\frac{5}{5}\frac{0}{0}\frac{5}{3}\frac{7}{7}\frac{2}{3}\frac{7}{1}$

(18.) A Gentleman pays Taxes for 350l. 14s. The Rental of the whole Village is 4714l. 11s. 10d. upon which a Tax is impoſed amounting to 2351l. 14s. 7d. what Sum muſt this Gentleman pay towards this Tax?—Anſ. 17l. 10s. $8\frac{1}{4}$d. $\frac{3}{5}\frac{2}{0}\frac{2}{3}\frac{6}{7}\frac{1}{3}\frac{7}{1}$

(19.) If a Tax of 9d. in the Pound be impoſed upon a Village for the Support of the Poor, what Sum muſt a Gentleman pay towards it, who pays Taxes for 350l. 14s.? Anſ. 13l. 3s. $0\frac{1}{4}$d. $\frac{1}{5}$

(20.) Bought 14 Hhds. of Sugar, each weighing 7cwt. 1qr. 14lb. at 2l. 14s. 9d. per cwt. what do they come to?—Anſ. 282l. 12s. $11\frac{1}{4}$d.

(21.) If a Pack of Wool weighs 2cwt. 2qr. 14lb. what is it worth at 17s. 6d. per Tod?—Anſ. 9l. 3s. 9d.

(22.) Bought 157 Fother of Lead at 5l. 5s. per Cwt. paid Carriage, &c. 5 Guineas; what does the Lead ſtand me in per lb.?—Anſ, $11\frac{1}{4}$d. $\frac{6}{4}\frac{3}{8}\frac{0}{6}\frac{0}{1}$

(23.) If an Ounce of Gold be worth 3l. what is the Worth of 14 Ingots, each weighing 3lb. 11oz. 15dwt. 13gr.?—Anſ. 2006l. 12s. 9d.

(24.) Bought

(24.) Bought 76 Pieces of Stuff for 722l. at 4s. 9d. per Yard; how many Yards did I buy, and how many Engliſh Ells did each Piece contain?—Anſ. 3040 yds. 32 ells, in each piece.

(25.) Bought 4 Tons of Oil for 247l. 11s.—64 Gallons of which being damaged, how muſt I ſell the Remainder per Gallon ſo as neither to gain nor loſe by the Bargain?—Anſ. 5s. $2\frac{3}{4}$d. $\frac{44}{59}$.

(26.) A Factor bought a Quantity of Broad-cloth and Baize for 124l.; the Quantity of Broad-cloth he bought was $117\frac{1}{2}$ Yards, at 17s. 9d. per Yard; for every 5 Yards of Broad-cloth he had $1\frac{1}{2}$ Yard of Baize:—how many Yards of Baize did he buy, and what did it coſt him per Yard?—Anſ. $35\frac{1}{2}$ yds. of baize, at 11s. $2\frac{1}{4}$d. $\frac{1}{47}$ per yard.

(27.) A Merchant in London bought 59 Tuns of Port-Wine for 12 Guineas per Hhd.; the Freight thereof, from Oporto to London, coſt 47l. 10s. the loading and unloading 7l. 10s. Cuſtom 24l. Charges of the Cellar 3 Guineas;—what was the prime Coſt of a Gallon of this Wine?—Anſ. 4s. $1\frac{1}{4}$d. $\frac{377}{1239}$.

(28.) A Draper bought 5 Packs of Cloth, each Pack containing 7 Parcels, each Parcel 15 Pieces, and each Piece 15 Ells E. 2qr. 3n.—For every 5 Yards he bought he gave 4l. 7s. 9. what did the 5 Packs of Cloth ſtand him in?—Anſ. 8954l. 12s. 3d. $\frac{3}{16}$.

*(29.) A Linen-draper received from Ireland 150 Pieces of Cloth, which ſtood him in 3s. $2\frac{1}{2}$d. per Yard, each Piece contained 25 Yards; what did the Whole come to?—Anſ. 601l. 11s. 3d.

*(30.) A Merchant bought 5 Hhds. of Madder, wt. 17 cwt. 2qr. for 52l. 10s. what coſt 1 cwt.?—Anſ. 3l.

*(31.) If 7 Tuns 2 Hhds. of Rum coſt 720l. what is 1 Tun worth?—Anſ. 96l.

*(32.) What Quantity of Raiſins can I have for 3l. 10s. if 7lb. coſt 2s. 11d.?—Anſ. $1\frac{1}{2}$cwt.

*(33.) How much Beef can I have for 200l. if 802 cwt. 1qr. 17lb. coſt 1300l.?—Anſ. 123cwt. 1qr. 22lb.

*(34.) If 3 Hhds. of Brandy coſt 68l. 17s. what will 7 Gallons be worth?—Anſ. 2l. 11s.

*(35.) If 2 Pipes of Oil coſt 82l. 10s. each Pipe 120 Gallons, what will 1 Jar, containing 20 Gallons, coſt?—Anſ. 6l. 17s. 6d.

*(36.) If for 2s. $7\frac{1}{2}$d. I can buy 7lb. of Raiſins, what Quantity can I have for 1059l. 14s. 3d.?—Anſ. 504cwt. 2qr. 14lb.

*(37.) Sold 4 Hhds. of Tobacco, No. 1, weighed 6 cwt. 3qrs. No. 2, 5cwt. 3qr. 11lb. No. 3, 7cwt. 16lb. No. 4, 9cwt. 1qr. 14lb. at 10¾d. per lb. what do they amount to?—Anſ. 146l. 1s. 3¾d.

*(38.) Shipped off 350 Caſks of Butter, wt. 546cwt. 2qrs. 14lb. which coſt me 2l. 5s. per cwt. paid Duty 6d. per cwt. Cooperage 2l. 16. 0½d. Boat-hire 18s. Porterage, &c. 2l. 3s. 7d. Cellarage 3l. 4s. 7d. what does 1 Cwt. of the Butter ſtand me in when on Board?—Anſ. 2l. 5s. 10d.

*(39.) Bought 3 Sorts of Rum, and an equal Quantity of each Sort; one Sort for 7s. per Gallon, a ſecond at 8s. and a third at 9s. per Gallon; what is a Gallon worth when mixed together?—Anſ. 8s.

*(40.) Bought three Sorts of Salt, and of each Sort an equal Quantity; the Price at 16s. 15s. and 20s. per Barrel, and the Whole amounted to 306l. how many Barrels had I?—Anſ. 120 barrels.

*(41.) A Merchant bought Goods to the Amount of 1450l. with Condition to deduct 1 per cent. for prompt Payment; how much muſt he pay?—Anſ. 1435l. 10s.

*(42.) A Piece of Land, 80 Rods long, and 70 broad, is to be laid out in Encloſures, of 20 Rods long, and 14 Rods broad; how many ſuch Encloſures will it make?—Anſ. 20.

*(43.) Bought 45 Quarters of Corn, at 42s. per Quarter, among which are 16qr. whereof four are worth but three of the reſt; how much muſt I pay?—Anſ. 86l. 2s.

*(44.) A Gentleman has an Annuity of 700l. I deſire to know how much he may ſpend daily, that at the Year's end he may lay by 150 Guineas, and give to the Poor 15s. 9d. a Week?—Anſ. 1l. 7s. 5¾d. rem. 53.

*(45.) If three Pieces and 15 Yards of Cloth, each Piece 54 Yards, coſt 106l. 4s. what coſt 1 Yard?—Anſ. 12s.

*(46.) If 60 Cwt. of Hops coſt 320l. what Quantity can I have for 4601l.?—Anſ. 862cwt. 2qr. 21lb.

*(47.) If 1½lb. of Cheeſe coſt 4d. what will 9lb. coſt?—Anſ. 2s.

*(48.) Bought 3 Hhds. of Brandy, Quantity 61, 62, and 62½ Gallons, at 8s. 9d. per Gallon; how much does the Whole come to?—Anſ. 81l. 3s. 1½d.

*(49.) I bought a Bale of Goods, weight 300lb for 151.4s. 9d. paid Duty 2d. per lb. Freight 25s. Porterage 1s. 6d. how much does 1lb. of the Goods ſtand me in?—Anſ. 1·5¼d.

*(50.) A Merchant bought Linen-cloth, at 11s. per Ell, which proving worſe than he expected, he is willing to ſell it at

at ſuch a Price that he may loſe preciſely 11. 13s. 4d. in every 20l. that he laid out; how muſt he ſell it per Ell?—Anſ. $10\frac{1}{12}$d.

*(51.) If a Perſon enjoy a Salary of 50 Guineas a Year, what is due to him for 147 Days Service?—Anſ. 21l. 2s. $10\frac{1}{2}$d. rem. 30.

*(52.) If a Man earn 2s. $6\frac{1}{2}$d. per Day, how much will be due to him for 19 Weeks, Sundays excepted?—Anſ. 14l. 9s. 9d.

*(53.) A Draper bought 56 Pieces of Kerſey, each Piece containing 34 Ells Engliſh, at the Rate of 5s. 4d. per Ell Flemiſh; what did the Whole come to?—Anſ. 846l. 4s. $5\frac{1}{4}$d.

(54.) xxx. A Tax of 225l. 10s. was laid upon four Villages, A, B, C, D, for repairing the Church:—It has been a Cuſtom with theſe Villages, Time immemorial, that, whenever any Taxes were to be levied, as often as A, B, and C, paid each 3d. D paid only 2d. What did each Village pay towards the Reparation of the Church?—Anſ. A, B, and C, paid each 61l. 10s. and D paid 41l.

(55.) xxxi. A Man bought 120 Eggs at 3 for a Penny, and afterwards 120 more, at 2 for a Penny; how many muſt he ſell for 5d. that he may loſe nothing?—Anſ. 12 Eggs.

(56.) xxxiv. Shipped for Jamaica 1750 Pair of Stockings at 4s. 5d. per Pair, and 1749 Yards of Manchester Cotton at 3s. 7d. per Yard, and in Return I have received 475 Gallons of Rum at 6s. $9\frac{1}{2}$d. per Gallon, and 27 Hhds. of Sugar, each weighing 7cwt. 3qr. 15lb. neat, at 3l. 15s. 7d. per Cwt.—What is the Balance between us, and in whoſe Favour?—Anſ. 265l. 18s. 9d. $\frac{3}{28}$ in my Favour.

(57.) xxxv. A Gentleman's yearly Income is 378ol. his weekly Expences amount to 32l. 15s. Land-tax, Repairs, &c. amount to $\frac{1}{9}$ of his annual Income; the charitable Donations which he diſtributes amount to $\frac{1}{20}$ Part of the Remainder, his Pocket Expences daily amount to $1\frac{1}{2}$ Guinea; what does he lay up at the Year's End?—Anſ. 999l. 5s. 6d.

(58.) xxxvi. Laid out 571l. 1s. 8d. in Wine, at 3s. 7d. per Gallon, which having received Damage, by Reaſon of ſome Pipes ſtaving, I found my Returns no more than 419l. 11s. by ſelling what came to Hand in good Order, at 7s. 6d. per Gallon; pray what Quantity of Wine was loſt?—Anſ. 8t. $52\frac{4}{115}$ gall.

(59.) xxxvii. A Merchant bought $22\frac{1}{2}$ Cwt. of Pepper, and $17\frac{1}{4}$ Cwt. of Ginger; the Pepper coſt him 14l. 19s. 7d. per Cwt. the Ginger 12l. 17s. 6d. what is the whole Value

of the Pepper and Ginger, and how muſt it be ſold per Oz. that he may gain 90l. by each Sort?—Anſ. $2\frac{1}{2}$d. $\frac{675}{403\frac{1}{2}}$ the Pepper, and $2\frac{1}{4}$d. $\frac{2\frac{1}{3}402}{403\frac{1}{2}}$ the Ginger.

(60.) xxxviii. Bought a Puncheon of Rum for 41l. 14s. 6d. to which I put as much Water as reduced the prime Coſt to 5s. 6d. per Gallon; what Quantity of Water did I put in?—Anſ. $67\frac{3}{11}$ gal.

(§ 14.) INVERSE PROPORTION.

Definition. *Inverſe*, or reciprocal, Proportion teaches by three given Numbers to find a fourth, in ſuch Proportion to the ſecond as the firſt is to the third.

RULE.

State the Queſtion as in the direct Rule. Multiply the firſt and ſecond Terms together, and divide the Product by the third, the Quotient will be the Anſwer, and of the ſame Denomination as you left the ſecond Number.

(1.) If a Field of Graſs be mowed by 10 Men in 12 Days, in how many Days would it be mowed by 20 Men?

1ſt number.		2d number.		3d number.
If 10m.	:	12d.	::	20m.
		10		
		2|0)12|0		
		6 days anſwer.		

(2.) A certain Piece of Graſs was to have been mowed by 20 Men in 6 Days; an extraordinary Occaſion calls off Half the Workmen:—it is required to find in what Time the Reſt will finiſh it?—Anſ. 12 days.

(3.) If the Penny-loaf weighs 8 oz. when Flour is at 2s. a Peck, what ſhould it weigh when Flour is ſold for 2s. 6d. the Peck?—Anſ. 6oz. $6\frac{12}{30}$ drs.

(4.) Proviſions in a Garriſon are found ſufficient to laſt 1800 Soldiers for three Months; but a Reinforcement being wanted

wanted, that the Provisions may last for 1 Month only, what Number of Soldiers may be added to the Garrison on this Emergency?—Ans. 3600.

(5.) If 3yds. 2qr. of Cloth of 1yd. 3qr. wide will make a Suit of Clothes, how many Yards of Stuff, of $\frac{1}{4}$ Yard wide, will make a Suit for the same Person, allowing the Taylor $\frac{3}{4}$ Yard for Cabbage?—Ans. $25\frac{1}{4}$yds.

(6.) If I lend my Friend 200l. for 12 Months, on Condition of his returning the Favour, how long ought he to lend me 150l. to requite my Kindness?—Ans. 16 months.

(7.) If a Statute-acre be 220 Yards long, the Breadth will be 22 Yards; but, if the Breadth of an Acre be 40 Yards, what will the Length be then?—Ans. 121yds.

(8.) If 720 Men be placed in a Garrison, and have Provisions for 6 Months; but hear of no Relief at the End of 5 Months, how many Men must depart, that the remaining Provisions may last 5 Months longer?—Ans. 576m.

(9.) If 5 Oxen, or 7 Colts, eat up a certain Quantity of Grass in 87 Days, in what Time will 2 Oxen and 3 Colts eat up the same Quantity of Grass?—Ans. 105 days.

(10.) A Regiment of Soldiers, consisting of 1000, are to be new clothed; each Coat to contain $2\frac{1}{2}$ Yards of Cloth of $1\frac{1}{4}$ Yard wide, and to be lined with Shalloon of $\frac{3}{4}$ Yard wide; how many Yards of Shalloon will line them?—Ans. 4166yds. $2\frac{2}{3}$qrs.

*(11.) A Merchant has agreed with a Carrier to carry 12 Cwt. of Goods 70 Miles, for 3l. 15s. but the Waggon being heavy laden, the Carrier is obliged to unlade 2cwt. of the said Goods; however, the Merchant is willing to give him the Sum agreed upon, provided he will carry the 10cwt. so much farther in Proportion; how many Miles must they be carried?—Ans. 84 miles.

*(12.) Bought 30 Yards of Cloth of 2 Yards wide, and would purchase Baize of 3 Yards wide to line it with; how many Yards shall I want?—Ans. 20 yards.

*(13.) If 136 Masons can build a Fort in 28 Days, and it were required to be built in 8 Days, how many Masons would finish it?—Ans. 476 masons.

*(14.) What Sum ought to be put to Interest at 6 per Cent. to gain in 1 Month as much as 100l. would gain in 12 Months?—Ans. 1200l.

*(15.) There is a Ciſtern, having a Cock, which will empty it in 12 Hours; how many Cocks of the ſame Size muſt there be to empty it in 5 Minutes?—Anſ. 144 cocks.

(§ 15.) THE RULE OF FIVE.

Definition. *The Rule of Five* is ſo called from its being compoſed of five Numbers to find a ſixth: it is ſometimes called the *Double Rule of Three*, becauſe all Queſtions that can be anſwered by it may be anſwered by two Statings in the Single Rule of Three.

RULE.

Let the principal cauſe of gain, loſs, or action, &c. be put in the firſt place; that number which denotes the ſpace of time, or diſtance of place, &c. be put in the ſecond place; and that number which is the gain, loſs, or action, &c. be put in the third place. That done, place the two terms which move the queſtion, underneath thoſe of the ſame name. Then, if the blank, or term ſought, fall under the third term, multiply the firſt and ſecond terms together for a diviſor, and the other three for a dividend; but, if the blank fall under the firſt or ſecond term, multiply the firſt, ſecond, and laſt terms together for a dividend, and the other two for a diviſor, and the quotient will be the anſwer.

The Method of Proof is by two ſingle Statings.

(1.) If 7 Men can reap 126 Acres in 12 Days, howmany Acres will 16 Men reap in 3 Days?

(2. If 7 Men can reap 126 Acres in 12 Days, howmany Men will reap 72 Acres in 3 Days?

1ſt term.

1st term.	2d term.	3d term.
If 7m.	: 12d.	: 126a.
16m.	: 3d.	: *

126
3

7 | 378
12 | 16

84) 6048(72a.
168

Anſwer 72 acres.

1ſt. term.	2d term.	3d term
If 7m.	: 12d.	: 126a.
*	: 3d.	: 72a. laſt term.

7
12

126 | 84
3 | 72

378) 6048 (16 m.
2268

Anſwer 16 men.

By two ſtatings.

If 7m.* : 126a. :: 16m. : 288a.
If 12d.* : 288a. :: 3d. : 72a.

Or thus,

If 7m. : 12d. :: 16m.* : 5¼d.
If 5¼d.* : 126a. :: 3d. : 72a.

By two ſtatings.

If 12d * : 126a. :: 3d. : 31½a.
If 31½a.* : 7m. :: 72a. : 16m.

Or thus,

If 12d. : 7m. :: 3d.* : 28m.
If 126a.* : 28m. :: 72a. : 16m.

The aſteriſms (*) point out the diviſors in the ſingle ſtatings.

(3.) If 7 Men in 12 Days can reap 126 Acres, in how many Days will 16 Men reap 72 Acres?—Anſ. 3 days.

(4.) A Carrier receives 15l. 12s. for the Carriage of 4½ Tons 18 Miles, how much will he carry 72 Miles for 20 Guineas?—Anſ. 1t. 10cwt. 1qr. 4lb. $\frac{4}{19}$.

(5.) If 100l. Principal, gain 4l. in 12 Months, what Principal will gain 20l. in 19 Months?—Anſ. 315l. 15s. 9¼d. $\frac{17}{19}$.

(6.) The Carriage of 11cwt. 2qr. for 150 Miles coſts 6l. 14s. 8d. how much muſt be paid for the Carriage of 15cwt. 1qr. 22lb. for 64 Miles at the ſame Rate?—Anſ. 3l. 17s. $2\frac{254}{1519}$d.

(7.) If a Regiment of 1878 Soldiers conſume 702 Quarters of Wheat in 336 Days, how many Quarters will an Army of 22536 Soldiers conſume in 112 Days?—Anſ. 2808qrs.

(8.) If 100l. at Intereſt for 1 Year, or 365 Days, gain 5l. how much will 144l. 14s. 9d. gain in 495 Days?—Anſ. 9l. 16s. 3¼d. $\frac{298}{365}$.

(9.) If 12 Tailors in 7 Days can finiſh 13 Suits of Clothes, how many Tailors, in 19 Days of the ſame Length, can finiſh the Clothes of a Regiment of Soldiers, conſiſting of 494 Men?—Anſ. 168 tailors.

(10.) An Ordinary of 100 Men drank 20l. Worth of Wine at 2s. 6d. per Bottle; how many Men, at the ſame Rate

Rate of drinking, will 7l. Worth ſuffice, when Wine is rated at 1s. 9d. per Bottle?—Anſ. 50 men.

†(11.) If the Carriage of 126lb. for 100 Miles coſt 6s. how many Pounds may I have carried 750 Miles for a Guinea?—Anſ. 58$\frac{4}{7}$lb.

†(12.) If a Garriſon of 3600 Men, in 35 Days, at 24oz. per Day each Man, eat a certain Quantity of Bread, how many Men, in 45 Days, at the Rate of 14oz. per Day each Man, will eat double the Quantity?—Anſ. 9600 men.

†(13.) If the Carriage of 150 Feet of Wood, that weighs 3 Stone a Foot, comes to 3l. for 40 Miles, how much will the Carriage of 54 Feet of Free-ſtone, that weighs 8 Stone a Foot, coſt for 25 Miles?—Anſ. 1l. 16s.

*(14.) If 1lb. of Thread make 3 Yards of Linen, of 1yd. 1qr. broad; how many lbs. of Thread would be wanted to make a Piece of Linen of 45 Yards long and 1 Yard broad?—Anſ. 12lb.

*(15.) If 3 Maſters, who have each 8 Apprentices, in 5 Weeks, each Week 6 Days, earn 36l. how much will 5 Maſters, who have each 10 Apprentices, earn in 8 Weeks, each Week 5$\frac{1}{2}$ Days, their daily Wages being equal with the former?—Anſ. 110l.

*(16.) If 6 Shoe-makers, in 4 Weeks, make 36 Pair of Men's Shoes, and 24 Pair of Women's, how many Pair of each Sort would 18 Shoe-makers make in 5 Weeks?—Anſ. 135 pair of men's ſhoes, and 90 pair of women's.

† The 11th, 12th, and 13th Examples, are the ſame with the 2d, 4th, and 6th Examples, in the Univerſal Rule of Proportion.

THE

THE

New Schoolmaster's Assistant,

OR

SCHOLAR's EASY GUIDE

TO

ARITHMETIC.

PART II.

(§ 1.) PRACTICE.

DEFINITION. *Practice* has its Name from its daily Use amongst Merchants and Tradesmen, being an easy and concise Method of working most Questions that occur in Trade and Business, and is only a Contraction of the Rule of Three when the first Term is an Unit.

A Table

A Table of the aliquot Parts of Money.

Of a Pound.

s.	d.	£
10	0	= 1/2
6	8	= 1/3
5	0	= 1/4
4	0	= 1/5
3	4	= 1/6
2	6	= 1/8
2	0	= 1/10
1	8	= 1/12
1	4	= 1/15

s.	d.	
1	3	= 1/16
1	0	= 1/20
	10	= 1/24
	8	= 1/30
	7½	= 1/32
	6	= 1/40
	5	= 1/48
	4	= 1/60
	3¾	= 1/64

Of a Shilling.

d.	
6	= 1/2
4	= 1/3
3	= 1/4
2	= 1/6
1½	= 1/8
1	= 1/12
¾	= 1/16
½	= 1/24
¼	= 1/48

A Table of the aliquot Parts of Weights and Measures.

Avoirdupois Weight.

Of a Ton.

Cwt.		
10	=	1/2
5	=	1/4
4	=	1/5
2½	=	1/8
2	=	1/10

Of a Cwt.

Qr.		
2 or 56lb.	=	1/2
1 or 28lb.	=	1/4
16	=	1/7
14	=	1/8

Of 1/2 Cwt. or 56lb.

lb.		
28	=	1/2
14	=	1/4
8	=	1/7
7	=	1/8

Of a 1/4 Cwt. or 28 lb.

lb.		
14	=	1/2
7	=	1/4
4	=	1/7
3½	=	1/8

Of a Pound.

Oz.		
8	=	1/2
4	=	1/4
2	=	1/8

Table

Table continued.

Troy Weight.

Of an Ounce.

dwt.	gr.		
10	0	=	½
6	16	=	⅓
5	0	=	¼
4	0	=	⅕
3	8	=	⅙
2	12	=	⅛
2	0	=	1/10
1	16	=	1/12

Of a Dwt.

gr.			
12		=	½
8		=	⅓
6		=	¼
4		=	⅕
3		=	⅛
2		=	1/12

Land-Measure.

Of an Acre.

R.	P.		
2	0	=	½
1	0	=	¼
	32	=	⅛
	20	=	⅕
	16	=	1/10
	8	=	1/20

Cloth-Measure.

Of a Yard.

Qr.	N.		
2	0	=	½
1	0	=	¼
	2	=	⅛
	1	=	1/10

Of an Engliſh Ell.

Qr.	N.		
2	2	=	½
1	1	=	¼
1	0	=	⅕
	2	=	1/10
	1	=	1/20

Of a Flemiſh Ell.

Qr.	N.		
1	2	=	½
1	0	=	⅖
	3	=	⅜
	2	=	⅕
	1	=	1/12

Of a French Ell.

Qr.	N.		
3	0	=	½
2	0	=	⅓
1	2	=	¼
1	0	=	⅕
	3	=	⅛
	2	=	1/12
	1	=	1/24

Rule

Rule 1. *When the Price is leſs than a Penny.* Divide the Quantity by the aliquot Parts in a Penny, then divide that Quotient by 12 and by 20.

(1.) What coſt 4715 Yards of Tape, at $\frac{1}{4}$d. per Yard?

$\frac{1}{4}|\frac{1}{4}|4715$

12)1178$\frac{3}{4}$d.

20) 98 2

£.4 18 2$\frac{3}{4}$.

(2.) 371 at $\frac{1}{4}$d.—Anſ. 7s. 8$\frac{3}{4}$d.
(3.) 425 at $\frac{1}{2}$d.—Anſ. 17s. 8$\frac{1}{2}$d.
(4.) 5714 at $\frac{3}{4}$d.—Anſ. 17l. 17s. 1$\frac{1}{2}$d.

Rule 2. *When the Price is an aliquot Part of a Shilling.* Divide the Quantity by the aliquot Part, and that Quotient by 20.

(5.) 425 Yards at 1d.

1d.$|\frac{1}{12}|425$

2|0)3|5 5

£.1 15 5

(6.) 3749 at 1d.—Anſ. 15l. 12s. 5d.
(7.) 496 at 1$\frac{1}{2}$d.—Anſ. 3l. 2s.
(8.) 3741 at 2d.—Anſ. 31l. 3s. 6d.
(9.) 574 at 3d.—Anſ. 7l. 3s. 6d.
(10.) 1749 at 4d.—Anſ. 29l. 3s.
(11.) 1731 at 6d.—Anſ. 43l. 5s. 6d.

Rule 3. *When the Price is Pence and Farthings, and they no aliquot Part of a Shilling.* Divide the given Quantity by ſome aliquot Part of a Shilling, then conſider what Part of this aliquot Part the Reſt is, and divide the Quotient thereby; this Quotient, added to the former, will be the Anſwer in Shillings, which divide by 20.

(12.) 354 at 1$\frac{1}{4}$d.

1d.$|\frac{1}{12}|354$

$\frac{1}{4}|\frac{1}{4}|$ 29 6
7 4$\frac{1}{2}$

2|0)3|6 10$\frac{1}{2}$

£.1 16 10$\frac{1}{2}$

(13.) 5714

(13) 5714 at 1¼d.—Anſ. 29l. 15s. 2½d.
(14) 142 at 1¾d.—Anſ. 1l. 0s. 8½d.
(15) 1749 at 2¼d.—Anſ. 16l. 7s. 11¼d.
(16) 134 at 2⅛d.—Anſ. 1l. 1s. 11d.
(17) 5794 at 2¾d.—Anſ. 66l. 7s. 9½d.
(18) 1749 at 3¼d.—Anſ. 23l. 13s. 8¼d.
(19) 574 at 3½d.—Anſ. 8l. 7s. 5d.
(20) 1749 at 3¾d.—Anſ. 27l. 6s. 6¾d.
(21) 749 at 4¼d.—Anſ. 13l. 5s. 3¼d.
(22) 1749 at 4½d.—Anſ. 32l. 15s. 10½d.
(23) 3749 at 4¾d.—Anſ. 74l. 3s. 11¾d.
(24) 173 at 5d.—Anſ. 3l. 12s. 1d.
(25) 146 at 5¼d.—Anſ. 3l. 3s. 10½d.
(26) 3741 at 5½d.—Anſ. 85l. 14s. 7½d.
(27) 1493 at 5¾d.—Anſ. 35l. 15s. 4¾d.
(28) 749 at 6¼d.—Anſ. 19l. 10s. 1¼d.
(29) 1741 at 6½d.—Anſ. 47l. 3s. 0½d.
(30) 349 at 6¾d.—Anſ. 9l. 16s. 3¾d
(31) 547 at 7d.—Anſ. 15l. 19s. 1d.
(32) 374 at 7¼d.—Anſ. 11l. 5s. 11½d.
(33) 5491 at 7½—Anſ. 171l. 11s. 10½d.
(34) 1649 at 7¾d.—Anſ. 53l. 4s. 11¾d.
(35) 1498 at 8d.—Anſ. 49l. 18s. 8d.
(36) 749 at 8¼d.—Anſ. 25l. 14s. 11¼d.
(37) 4719 at 8½d.—Anſ. 167l. 2s. 7½d.
(38) 1747 at 8¾d.—Anſ. 63l. 13s. 10¼d.
(39) 4954 at 9d.—Anſ. 185l. 15s. 6d.
(40) 7143 at 9¼.—Anſ 275l. 6s. 0¾d.
(41) 494 at 9½d.—Anſ. 19l. 11s. 1d.
(42) 374 at 9¾d.—Anſ. 15l. 3s. 10½d.
(43) 471 at 10d.—Anſ. 19l. 12s. 6d.
(44) 3751 at 10¼d.—Anſ. 160l. 3s. 11¾d.
(45) 4967 at 10½d.—Anſ. 217l. 6s. 1½d.
(46) 4971 at 11d.—Anſ. 227l. 16s. 9d.
(47) 5794 at 11¾d.—Anſ. 283l. 13s. 3½d.

Rule 4. *When the Price is more than one Shilling, but leſs than two,* Let the given Number ſtand for Shillings, and work for the Pence and Farthings by the preceding Rules.

(48) 4756 at 12¼d.

¼	1	4756
		99 1
2	0	485 5 1
£.		242 15 1

(49) 321 at 12½d.—Anſ. 16l 14s. 4½d.
(50) 479 at 12¼d.—Anſ. 25l. 8s. 11¼d.
(51) 574 at 13d —Anſ. 31l. 18. 10d.
(52) 675 at 13¼d.—Anſ. 37l 5s 3¾d.
(53) 4949 at 13½d.—Anſ. 278l. 7s. 7½d.
(54) 574 at 13¾d.—Anſ. 32l. 17s. 8½d.
(55) 495 at 14d —Anſ. 28l. 17s. 6d.
(56) 5714 at 14¼d.—Anſ. 339l. 5s. 4½d.
(57) 371 at 14½d.—Anſ. 22l. 8s. 3½d.
(58) 4714 at 14¾d.—Anſ. 289l. 14s. 3½d.
(59) 3719 at 15d.—Anſ. 232l. 8s. 9d.
(60) 174 at 15¼d.—Anſ. 11l. 1s. 1½d.
(61) 4749 at 15½d.—Anſ. 306l. 14s. 1½d.
(62) 374 at 15¾d.—Anſ. 24l. 10s. 10½d.
(63) 498 at 16d.—Anſ. 33l. 4s.
(64) 3714 at 16¼d.—Anſ. 251l. 9s. 4½d.
(65) 5714 at 16½d.—Anſ. 392l. 16s. 9d.
(66) 494 at 16¾d.—Anſ. 34l. 9s. 6½d.
(67) 3751 at 17d.—Anſ. 265l. 13s. 11d.
(68) 494 at 17¼d.—Anſ. 35l. 10s. 1½d.
(69) 375 at 17½d.—Anſ. 27l. 6s. 10½d.
(70) 5794 at 17¾d.—Anſ. 428l. 10s. 3½d.
(71) 4954 at 18d.—Anſ. 371l. 11s.
(72) 371 at 18¼d.—Anſ. 28l. 4s. 2¼d.
(73) 579 at 18½d.—Anſ. 44l. 12s. 7½d.
(74) 3751 at 18¾d.—Anſ. 293l. 0s. 11¼d.
(75) 479 at 19d.—Anſ. 37l. 18s. 5d.
(76) 371 at 19¼d.—Anſ. 29l. 15s. 1¾d.
(77) 471 at 19½d.—Anſ. 38l. 5s. 4½d.
(78) 579 at 19¾d.—Anſ. 47l. 12s. 11¼d.
(79) 471 at 20d.—Anſ. 39l. 5s.
(80) 3741 at 20¼d.—Anſ. 315l. 12s. 11¼d.
(81) 494 at 20½d.—Anſ. 42l. 3s. 11d.
(82) 379 at 20¾d.—Anſ. 32l. 15s. 4¼d.
(83) 4981 at 21d.—Anſ. 435l. 16s. 9d.
(84) 375 at 21¼d.—Anſ. 33l. 4s. 0¾d.
(85) 3741 at 21½d.—Anſ. 335l. 2s. 7½d.
(86) 495 at 21¾d.—Anſ. 44l. 17s. 2¼d.
(87) 5947 at 22d.—Anſ. 545l. 2s. 10d.
(88) 5931 at 22¼d.—Anſ. 549l. 17s. 0¾d.
(89) 432 at 22½d.—Anſ. 40l. 10s.
(90) 541 at 22¾d.—Anſ. 51l. 5s. 7¾d.
(91) 7194 at 23d.—Anſ. 689l. 8s. 6d.
(92) 5497 at 23¼d.—Anſ. 532l. 10s. 5¼d.

(93) 174

(93) 714 at 23½d.—Anſ. 69l. 18s 3d.
(94) 4984 at 23¾d.—Anſ. 493l. 4s. 2d.
(95) 4935 at 23½d.—Anſ. 483l. 4s. 4½d.
(96) 3714 at 23¾d.—Anſ. 367l. 10s. 7½d.

Rule 5. *When the Price is any Number of Shillings leſs than* 20. If the number of ſhillings be even, multiply the quantity by half the price, double the firſt figure in the product for ſhillings, and the reſt of the product will be pounds. If the number of ſhillings be odd, find the value for the greateſt even number as before, to which add $\frac{1}{20}$ of the given quantity for the odd ſhilling, and the ſum will be the anſwer.

(97) What coſt 425 pair of buckles at 6s. per pair?

Here ½ the price is 3s. and 425 multiplied by 3 gives 1275 for the product; double the firſt figure (viz. 5) for ſhillings, and let the 127 ſtand for pounds; then the anſwer will be 127l. 10s.—Had the buckles been 7s. per pair, then $\frac{1}{20}$th of 425 (viz. 21l. 5s.) muſt have been added to 147l. 10s. and the anſwer would have been 148l. 15s.

(98) 475 at 2s.—Anſ. 47l. 10s.
(99) 379 at 3s.—Anſ. 56l. 17s.
(100) 1754 at 4s.—Anſ. 350l. 16s.
(101) 1788 at 5s.—Anſ. 447l.
(102) 1789 at 6s.—Anſ. 536l. 14s.
(103) 414 at 7s.—Anſ. 144l. 18s.
(104) 5413 at 8s.—Anſ. 2165l. 4s.
(105) 7194 at 9s.—Anſ. 3237l. 6s.
(106) 344 at 10s.—Anſ. 172l.
(107) 794 at 11s.—Anſ. 436l. 14s.
(108) 427 at 12s.—Anſ. 256l. 4s.
(109) 149 at 13s.—Anſ. 96l. 17s.
(110) 371 at 14s.—Anſ. 259l. 14s.
(111) 495 at 15s.—Anſ. 371l. 5s.
(112) 3741 at 16s.—Anſ. 2992l. 16s.
(113) 794 at 17s.—Anſ. 674l. 18s.
(114) 494 at 18s.—Anſ. 444l. 12s.
(115) 371 at 19s.—Anſ. 352l. 9s.

Rule 6. *When the Price is Shillings and Pence.* If they are an aliquot part of a pound, divide the quantity by that aliquot part, and the quotient will be the anſwer. If they are not an aliquot part, multiply the quantity by the ſhillings, and take parts for the reſt.

(116) 3754 Pair of gloves at 2s. 6d. per pair.

2s. 6d. | ½ | 3754

£469 5

(117) 3520 Bushels at 3s. 6d.

3

6d. | ½ | 10560
1760

2|0)1232|0

£616

(118) 660 at 2s. 6d.—Anſ. 82l. 10s.
(119) 960 at 3s. 4d.—Anſ. 160l.
(120) 574 at 5s. 7d.—Anſ. 616l.
(121) 712 at 6s. 8d.—Anſ. 237l. 6s. 8d.
(122) 512 at 7s. 6d.—Anſ. 192l.
(123) 1749 at 5s. 8d.—Anſ. 495l. 11s.
(124) 3741 at 4s. 6d.—Anſ. 841l. 14s. 6d.
(125) 493 at 3s. 2d.—Anſ. 78l. 1s. 2d.
(126) 741 at 5s. 9d.—Anſ. 213l. 0s. 9d.

Rule 7. *When the Price is Pounds and Shillings.* Multiply the quantity by the pounds, and proceed with the ſhillings as in Rule 5.

(127) 7341 at 2l. 6s.

7341
2

14682 value at 2l.
2202 6 value at 6s.

£16884 6 anſwer.

(128) 435 at 2l. 7s.

2

870 value at 2l.
130 10 value at 6s.
21 15 value at 1s.

£1022 5 anſwer.

(129) 754 at 4l. 2s.—Anſ. 3091l. 8s.
(130) 371 at 5l. 3s.—Anſ. 1910l. 13s.
(131) 149 at 9l. 4s.—Anſ. 1370l. 16s.
(132) 374 at 10l. 5s.—Anſ. 3833l. 10s.
(133) 191 at 12l. 6s.—Anſ. 2349l. 6s.
(134) 174 at 3l. 7s.—Anſ. 582l. 18s.
(135) 512 at 5l. 8s.—Anſ. 2764l. 16s.
(136) 140 at 7l. 9s.—Anſ. 1043l.
(137) 360 at 2l. 10s.—Anſ. 900l.
(138) 344 at 2l. 11s.—Anſ. 877l. 4s.
(139) 192 at 3l. 12s.—Anſ. 691l. 4s.
(140) 351 at 4l. 13s.—Anſ. 1632l. 3s.
(141) 412 at 5l. 14s.—Anſ. 2348l. 8s.
(142) 372 at 2l. 15s.—Anſ. 1023l.
(143) 741 at 1l. 16s.—Anſ. 1333l. 16s.
(144) 314 at 1l. 17s.—Anſ. 580l. 18s.
(145) 471 at 1l. 18s.—Anſ. 894l. 18s.
(146) 374 at 19l. 19s.—Anſ. 7461l. 6s.

Rule

Rule 8. *When the Price is Pounds, Shillings, Pence, and Farthings.* Multiply the quantity by the pounds, and work for the reſt by the preceding Rules.

(147) 4514 at 2l. 17s. 7¼d.

2

	9028		value at 2l.
	3611	4	ditto at 16.
6 | ½ |	225	14	ditto at 1s.
1½ | ¼ |	112	17	ditto at 6d.
	28	4	3 ditto at 1¼d.

£13005 19 3 anſwer.

(148) 471 at 5l. 14s. 9¼d.—Anſ. 2702l. 17s. 0¾d.
(149) 3714 at 2l. 13s. 11½d.—Anſ. 10023l. 18s. 7½d.
(150) 415 at 4l. 11s. 10½d.—Anſ. 1906l. 8s. 1½d.
(151) 341 at 5l. 13s. 9½d.—Anſ. 1940l. 2s. 11½d.
(152) 7494 at 10l. 17s. 10½d.—Anſ. 81637l. 15s. 3d.
(153) 34124 at 1l. 14s. 8¾d.—Anſ. 40049l. 13s. 10¾d.
(154) 7251 at 14l. 11s. 5½d.—Anſ. 105668l. 4s. 4½d.

Rule 9. *If there be a Fraction in the given Quantity,* work for the whole number by ſome of the preceding Rules, and find the produce of the fraction by multiplying the price by the numerator, and dividing the product by the denominator; then add them together for the anſwer.

(155) 3749⅜ at 3l. 15s. 6d.

3l. 15s. 6d. the price.				3749			
		3				3	
8)11	6	6	three times ditto.	11247			
				2624	6		
1	8	3¾	3-8ths of ditto.	6d. ½ |	187	9	
					93	14	6
				⅜ add	1	8	3¾
				£14153	17	9¾	anſwer.

Note, ⅜ of 3 times the price is the ſame as 3 times ⅜ of the price, or ⅜, by the nature of fractions.

(156) 371⅔ at 3l. 14s. 7½d.—Anſ. 1385l. 0s. 9½ ⅔
(157) 4917⅛ at 4l. 18s. 10½d.—Anſ. 24309l. 0s. 8¾d. ⅛
(158) 1375⅚ at 2l. 19s. 11¾d.—Anſ. 4125l. 4s. 8d. ⅚
(159) 4759 1/11 at 4l. 15s. 9¾d.—Anſ. 22799l. 0s. 4¾d. 1/11
(160) 5745⅕ at 19l. 11s. 6d.—Anſ. 112471. 15s. 10¾d. ⅕
(161) 1749 1/12 at 4l. 19s. 10¾d.—Anſ. 8732l. 13s. 3d. 1/12

Rule 10. *When the given Quantity is of ſeveral Denominations.* Find the value for the integers, if any, and take parts of the price with the parts of the integer.

(162) What is the value of 18cwt 1qr 11lb of tobacco, at 6l. 19s. 11d. per cwt.

	l.	s.	d.	
1qr. is ¼ cwt.	6	19	11	
			2	
	13	19	10	
			9	
	125	18	6	value of 18 cwt.
7 lb. ½	1	14	11½	value of ¼ cwt.
3½ lb. ½		8	8¾	ditto of 7lb.
½ lb. ⅐		4	4½	ditto of 3½lb.
			7½	ditto of ½lb.
	£128	7	2	answer.

(163) 19cwt 3qr 11lb of hops, at 4l. 11s. 9d. per cwt.—Anſ. 91l. 1s. 6¾d.

(164) 19cwt 3qr 19lb of ſugar, at 2l. 4s. 8d. per cwt.—Anſ. 44l. 9s. 8¾d.

(165) 11cwt 1qr 16lb of ſoap, at 3l. 7s. per cwt.—Anſ. 38l. 3s. 3¾d.

(166) 9cwt 3qr 10lb of treacle, at 1l. 18s. 9d. per cwt.—Anſ. 19l. 1s. 3¼d.

(167) 9ton 13cwt 3qr 19lb at 14l. 15s. 9d. per ton.—Anſ. 143l. 7s. 7d.

(168) 3qr 19lb 10oz at 11l. 12s. 5½d. per cwt.—Anſ. 10l. 15s. 0¼d.

(169) 74oz 2dwt 12gr of ſilver, at 4s. 11½d. per oz.—Anſ. 18l. 7s. 6¼d.

(170) A pair of chaſed ſilver ſalts, weight 7oz 11dwt at 8s. 11d½d. per oz.—Anſ. 3l. 7s. 5½d.

(171) 571oz 14dwt 16½gr at 3l. 11s. 9¼d. per oz.—Anſ. 2051l. 13s. 10d.

(172) What is the rent of 725a 2r 19p of land, at 2l. 11s. 9d. per acre?—Anſ. 1877l. 10s. 9d.

(173) 51a 3r 15p at 4l. 10s. per acre.—Anſ. 233l. 5s. 11¼d.

(174) 97a 14p at 3l. 11s. 10d. per acre.—Anſ. 348l. 14s. 1¼d.

(175) 514yds 3qr 2n at 17s. 9½d. per yard.—Anſ. 458l. 5¾d.

(176) 125 ells Engliſh, 1qr 1n at 1l. 11s. 9½d. per ell.—Anſ. 199l. 18s. 10¾d.

(177) What

(177) What cost 17 French ells 1qr 3n of Brussels lace, at 3l. 19s. 11½d per ell.—Ans. 69l. 2s. 7½d.

(178) 349 Flemish ells 1qr 3n of Holland, at 1l. 11s. 6d. per ell.—Ans. 551l. 11s. 10½d.

(179) 475yds 3qr 2n at 1l. 14s. 9½d. per ell English.—Ans. 661l. 17s. 3d.

(180) 3753 ells Eng. at 18s. 11½d. per yard.—Ans. 4451. 5s. 4½d.

(§. 2.) TARE and TRET.

Definition 1. *Tare and Tret* are practical Rules for deducting certain allowances made by merchants and tradesmen in selling their goods by weight.

2. *Tare* is an allowance made to the buyer for the weight of the box, barrel, bag, chest, wrappers, &c.

4. *Cloff*, or *Draught*, is an allowance of 2lb for every 3 cwt made by the seller to the buyer, that the weight may hold good when sold by retail.

5. *Gross Weight* is the whole weight of any sort of goods, together with the box, barrel, &c. that contains it.

6. *Suttle* is when part of the allowance is deducted from the gross.

7. *Neat Weight* is what remains after all allowances are deducted.

Proposition I.

When the Tare is at so much in the whole gross Weight to find the neat Weight.

Rule. Subtract the Tare from the Gross, and the remainder will be the neat weight.

(1.) What is the neat weight of 6 hhds of tobacco, each weighing 12cwt 3qr 11lb gross, Tare in the whole 854lb.?

12cwt. 3qr. 11lb.			28)854	
6			4)30—14	
77	0	10 whole gross weight	7	2 14
7	2	14 tare.		
69	1	24 neat weight.		

(2.) Required

(2.) Required the neat weight of 27 bales of silk, each weighing 349½lb gross; Tare in the whole 3cwt 1qr 15lb.—Ans. 80cwt 3qr 13½lb.

(3.) Required the neat weight of 29 hhds of tobacco, each weighing 14cwt 3qr 17lb gross; Tare in the whole 1547lb.—Ans. 418cwt 1qr 10lb.

(4.) In 43 bags of cotton, each weighing 3cwt 1qr 11½lb. gross; Tare in the whole 77½lb. what is the neat weight?—Ans. 143cwt 1qr 25lb.

(5.) What is the neat weight of 4 hhds of sugar, weighing as follows, viz.

No.	Cwt.	qr.	lb.		lb.
1	5	3	11	Tare	25
2	4	1	10	—	28
3	7	2	14	—	37
4	9	1	24	—	53
Ans.	26	0	10		

PROPOSITION II.

When the Tare is at so much per Box, Bag, Barrel, &c. to find the neat Weight.

Rule. Multiply the number of boxes, bags, &c. by the Tare, and subtract the product from the Gross.

(6.) What is the neat weight of 12 hhds of tobacco, each weighing 5cwt 3qr 14lb gross; Tare per hhd 97lb?

cwt.	qr.	lb.		lb.
5	3	14		97
		12		12
70	2	0	whole gross weight	28)1164
10	1	16	tare.	
60	0	12	neat weight.	4)41—16
				10 16

(7.) Required the neat weight of 19 casks of indigo, each weighing 4cwt 1qr 14lb gross; Tare per cask 37lb.—Ans. 76cwt 3qr 11lb.

(8.) Required the neat weight of 47 hhds of tobacco, weighing 1147cwt 1qr 11lb. gross; Tare 75lb per hhd.—Ans. 113cwt 3qr 14lb.

(9.) In 19 bags of pepper, each 84¼lb gross, Tare per bag 4¼lb. how many lbs. neat?—Ans. 1524¾lb.

(10.) In 75 bales of silk, each weighing 254lb gross, Tare per bale 14lb how many lbs neat?—Ans. 18000lb.

(11.) What

(11.) What is the neat weight of 354 barrels of figs, each weighing 124lb groſs; tare 11lb per barrel?—Anſ. 357cwt. 18lb.

PROPOSITION III.

When the Tare is at ſo much per Cent. to find the neat Weight.

Rule. If the Tare be an aliquot part of a cwt. divide the groſs weight by the aliquot part, and the quotient will be the tare to be deducted from the groſs. If the Tare is not an aliquot part of a cwt. firſt take ſome aliquot part of a cwt. and then part of *that* part, &c. according to the nature of the queſtion, the ſum of the quotients belonging to theſe parts will be the whole Tare, which deduct from the groſs.

(12.) What is the neat weight of 7 barrels of figs, each weighing 2cwt 1qr 12lb groſs; Tare 21lb per cwt?

		cwt.	qr.	lb.	
		2	1	12	
				7	
14lb.	¼	16	2	0	groſs.
7lb.	½	2	0	7	tare at 14lb. per cwt.
		1	0	3½	ditto at 7lb. per cwt.
		3	0	10½	whole tare.
		13	1	17½	neat weight.

(13.) Required the neat weight of 29 barrels of potaſh, each weighing 1cwt 3qr 18lb groſs; Tare 12lb per cwt.—Anſ. 49cwt 1qr 25lb.

(14.) Required the neat weight of 15 caſks of argol, weighing groſs 97cwt 2qr 15lb Tare 15lb per cwt?—Anſ. 84cwt 2qr 6lb.

(15.) Required the neat weight of 19 barrels of anchovies, each weighing 35lb groſs; Tare 11½lb per cwt.—Anſ. 596 $\frac{161}{512}$lb.

(16.) Required the neat weight of 17 hhds of tobacco, each weighing 4cwt 3qr 14lb groſs; Tare 19lb per cwt.—Anſ. 68cwt 3qr 7lb.

PRO-

PROPOSITION IV.

The gross Weight of any Sort of Merchandise given to find the neat Weight when Tret is allowed with Tare.

Rule. Find the Tare, as before, and subtract it from the Gross, the remainder will be the *suttle*. Then, divide the suttle by 26, and the quotient will be the Tret, which deduct from the suttle.

(17.) In 7hds of sugar, weighing gross 47cwt 2qr 4lb. Tare in the whole 10cwt 2qr 14lb, Tret 4lb per 104, how much neat weight?

cwt.	qr	lb.	
47	2	4	gross.
10	2	14	tare.
26)36	3	18	suttle.
1	1	19	tret.
35	1	27	neat.

(18.) How much neat weight is contained in 12cwt 3qr 19lb gross, Tare in the whole 37lb Tret 4lb per 104?—Ans. 12cwt 11lb.

(19.) Required the neat weight of 19 chests of sugar, each weighing 7cwt 3qr 19lb gross, Tare 12lb per cwt. Tret 4lb per. 104.—Anf. 129cwt 20lb.

(20.) Suppose 19½lb per cwt Tare, and 4lb per 104lb Tret, were allowed on 19 casks of prunes, each 4cwt 1qr 14lb gross, what would be the neat weight?—Anf. 66cwt 21lb.

PROPOSITION V.

The gross Weight of any Sort of Merchandise given to find the neat Weight, when Tare, Tret, and Cloff are allowed.

Rule. Find the neat weight by the last Rule, and call that the *second* suttle. Then divide the second suttle by 168, and the quotient will be the cloff, which deduct from the second suttle.

(21.) Required the neat weight of 45 hhds of tobacco, weighing gross 224cwt 3qr 20lb. Tare 25cwt 3qr. Tret 4lb per 104lb. Cloff 2lb for every 3 cwt.

cwt

cwt.	qr.	lb.	
224	3	20	groſs.
25	3	0	tare.
26)199	0	20	ſuttle.
	7	2	18 tret.
168)191	2	2	ſecond ſuttle.
	1	0	$15\frac{10}{28}$ cloff.
190	1	14	$\frac{9}{28}$ neat.

(22.) In 7 hhds of tobacco, each weighing groſs 5cwt 3qr 17lb. Tare 11lb per cwt. Tret 4lb per 104, Cloff 2lb. for every 3cwt how much neat weight?—Anſ. 35cwt 2qr 12lb.

(23.) The neat weight of 5 caſks of currants is required, each weighing 7cwt 3qr 11lb groſs, Tare 2qr 11lb per caſk, Tret 4lb per 104lb. and Cloff 2lb per 336lb.—Anſ. 34cwt 2qr 16lb.

BILLS of PARCELS, exerciſing TARE and TRET.

(1.) xxi. Mr. Coſe,

Bought of George Mitchell,

London, May 1, 1791.

cwt.	qr.	lb.		
16	1	19	groſs of ſugar, Tare 124lb at 3l. 10s. per cwt neat —	£.
21	2	17	—— of ditto, Tare 137lb at 4l. 4s. per cwt neat —	
19	1	21	—— of raiſins, Tare 96lb at 2l. 7s. per cwt. neat —	
11	3	14	—— of currants, Tare 85lb. at 2l. 10s. 4d. per cwt neat —	
5	1	17	—— of pimento, Tare 47lb at 5l. 5s. per cwt neat —	
7	2	19	—— of ginger, Tare 74lb at 5l. 6s. 6d.	
				£274 10 $2\frac{1}{4}$

Received at the ſame time the Contents,

George Mitchell.

(2.) xxii. Mr.

(2.) xxii. Mr. George Lane.

Bought of James Khuff, 5 Bags of Cotton, viz.

London, June 5, 1791.

	Cwt.	qr.	lb.		qr.	lb.		
No. 1.	5	1	4	groſs, Tare	1	4	l. s. d.	
2.	7	2	11	—— —	2	5½	at 4 18 11	
3.	4	3	9	—— —	2	21¼	per cwt.	
4.	5	0	14	—— —	1	19¾	ne a £.	
5.	6	2	17	—— —	2	14½		

£135 11 4½

(3.) xxiii. Meſſrs. Langton and Co.

To Stephen Memprize, Drs.

Hull, 1791.

April 8. To 17cwt 2qr 24lb groſs of Lump-Sugar, Tare 14lb per cwt at 4l. 17s. 6d. per cwt neat — £.

—— To 27cwt 1qr 19lb groſs of double refined Sugar, Tare 16lb per cwt at 5l. 5s. per cwt neat — —

May 10. To 19cwt 3qr 16lb groſs of Rice, Tare 8lb per cwt. at 1l. 10s. 4d. per cwt neat

—— 17. To 10cwt 8lb groſs of Malaga Raiſins, Tare 14lb per cwt at 3l. 1s. 5d. per cwt. neat —

June 6. To 8cwt 3qr 7lb groſs of Currants, Tare 7lb per cwt. at 2l. 17s. 8d. per cwt. neat —

—— To 1cwt 1qr 21lb of Pepper, Tare 12lb per cwt. at 6l. 18s. 2d. per cwt. neat

£.286 14 7¼

Received, July 17, 1791, 50l. 10s. 6d. in part of this Bill, Stephen Memprize.

(4.) xxiv. Mr. Henry Chapman,

Bought of George Evitt, 5 Barrels of Indigo,

London, May 1, 1791.

	Cwt.	qr.	lb.					
No. 1.	Qt. 10	2	14	groſs, Tare	7lb	per cwt.	at £.	
2.	— 11	3	12	—— —	7	—	2s. 4⅛d.	
3.	— 12	1	17	—— —	8	—	per lb.	
4.	— 9	2	14	—— —	8	—	neat.	
5.	— 10	1	14	—— —	7	—		

£672 16 0½

(5.) xxv.

(5.) xxv. Mr. Amutie,

Bought of William Wilson,

London, March 5, 1791.

		£
7	Hhds of Sugar, each 10cwt 1qr 12lb groſs, Tare 17lb per hhd, at 2l. 8s. 10d. per cwt neat	
3	Hhds of Pimento, each 4cwt 7lb groſs, Tare 21lb per hhd, at 5l. 1s. 6d. per cwt neat —	
5	Hhds of Ginger, each 7cwt 3qr groſs, Tare 13lb per hhd, at 6l. 7s. 4d. per cwt neat —	
6	Hhds of Pepper, each 3cwt 2qr 9lb groſs, Tare 19lb per hhd, at 5l. 7s. 3d. per cwt. neat	
8	Hhds of Tobacco, each 12cwt 1qr 24lb. groſs, Tare 29lb per hhd, at 6l. 6s. 8d. per cwt. neat	
		£1204 11 6¾

(6.) xxvi. Francis Clarke, Eſq.

Bought of John Jenkins,

London, April 9, 1791.

Five Buts of Currants, *viz.*

No. 1.	4cwt 1qr 12lb groſs, Tare 19lb per cwt Tret 4lb per 104lb	at 2l. 1s. 8d. per cwt. neat
2.	9cwt 2qr 17lb groſs, Tare 21lb per cwt Tret 4lb per 104 —	
3.	8cwt 3qr groſs, Tare 9lb per cwt Tret 4lb. per 104 —	
4.	7cwt. 11lb groſs, Tare 47lb in the whole, Tret 4lb per 104 —	
5.	9cwt 1qr 9lb groſs, Tare 7lb per cwt, Tret 4lb per 104 —	
		£33 2 11¼

(7.) xxvii. Granville King, Esq.

Bought of John Russell,

London, May 16, 1788,

Tobacco in leaf, 19cwt 1qr 27lb gross, Tare 149lb at 5l. 0s. 4d. per cwt neat £

Ditto in Rolls, 12cwt 3qr 19lb gross, Tare 48½lb at 5l. 17s. 8d. per cwt neat

Pimento, 4cwt 2qr 25lb gross, Tare 17¾lb at 7l. 13s. 5d. per cwt neat

Cotton, 16cwt 0qr 17lb gross, Tare 125lb at 4l. 15s. 4d. per cwt neat

Sugar, 21cwt 1qr 2lb gross, Tare 158¾lb at 2l. 1s. 7d. per cwt neat

Nutmegs, 3cwt 0qr 6lb gross, Tare 12¾lb at 15l. 8s. 9d. per cwt neat

£357 18 3¾

Received at the same time the Contents,

John Russell.

(8.) xxix. Wilmer Willet, Esq.

Bought, of Francis Duke, 6 Buts of Madder,

London, Nov. 4, 1791.

No. 1. Wt gross 11cwt 2qr. Tare 14lb per cwt Tret 4lb. per 104lb and Cloff 2lb for every 3 cwt at 3l. 5s. per cwt neat £

2. Wt gross 10cwt 1qr. 14lb Tare 7lb per cwt. Tret 4lb. per 104lb and Cloff 2lb for every 3 cwt at ditto

3. Wt gross 9cwt 3qr. Tare 16lb. Tret 4lb. per 104lb. and Cloff 2lb. for every 3 cwt at ditto

4. Wt gross 12cwt 16lb. Tare 8lb per cwt. Tret 4lb. per 104lb. and Cloff 2lb for every 3 cwt at ditto

5. Wt gross 9cwt 1qr 14lb. Tare 12lb per cwt. Tret 4lb. per 104lb. and Cloff 2lb for every 3cwt at ditto

6. Wt gross 10cwt. Tare 10lb per cwt. Tret 4 lb. per 104lb. and Cloff 2lb for every 3 cwt at ditto

£176 16 1¼

(§. 3.) IN-

(§. 3.) INTEREST.

Definition 1. *Intereſt* is the premium, or money, which one perſon allows to another for the uſe of any ſum of money for a determinate ſpace of time.

2. *The Principal* is the money lent.

3. *The Rate per Cent* is a certain ſum, agreed on between the borrower and the lender, to be paid for the uſe of every 100l. in the principal for a year.

4. *The Amount* is the principal and its intereſt added together.

(§. 4.) SIMPLE INTEREST.

Definition. Simple Intereſt is the money ariſing from the principal only, though ſuch intereſt ſhould remain unpaid for any number of years; thus, if the intereſt of £100 for 1 year be £4, it will be £8 for 2 years, &c. or £2 for half a year, £1 for a quarter of a year, &c.

PROPOSITION I.

To find the Intereſt of any Sum of Money, having the Principal, the Time of its Continuance in Years, and the Rate per Cent. given.

Rule. Multiply the principal by the rate per cent. that product, divided by 100, will give the intereſt for one year. Then, if the intereſt for one year be multiplied by the number of years given in the queſtion, the product will be the intereſt for *that* time.

Note 1. If there be any parts annexed to the whole years, as $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, &c. after you have found the intereſt for the number of years, add $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, &c. of one year's intereſt to it.

2. If the rate of intereſt have any part, or parts, annexed to it, as $\frac{1}{4}$ or $\frac{3}{4}$, &c. after you have multiplied the principal by the whole number, take the reſpective part, or parts, of the principal, which add to the product, and proceed for the given time as above.

(1.) What is the intereſt of 357l. 10s. per 3 years, at 5 per cent. per annum?

357l. 10s. principal.
5 rate per cent.

17,87 10
20

17,50
12

6,00

17l. 17s. 6d. intereſt for 1 year.
3

53 12 6 intereſt for 3 yeats.

Or thus,

5l. is $\frac{1}{20}$ | 357l. 10s.

17 17 6 intereſt for 1 year.
3

53 12 6 intereſt for 3 years.

(2.) Required the intereſt of 349l. 10s. for 7 years, at 4 per cent. per annum.—Anſ. 97l. 13s. 1d.

(3.) Required the intereſt of 429l. 11s. 6d. for 6 years, at 5 per cent. per annum.—Anſ. 128l. 17s. $4\frac{1}{2}$d.

(4.) What is the intereſt of 625l. 15s. for $3\frac{1}{2}$ years, at 4 per cent per annum.—Anſ. 87l. 12s. $0\frac{1}{2}$d.

(5.) What is the intereſt of 494l. 13s. 9d. for $5\frac{3}{4}$ years, at 5 per cent per annum.—Anſ. 421. 4s. $5\frac{1}{4}$d.

(6.) Required the intereſt of 700 guineas, for 9 years, at $4\frac{1}{4}$ per cent. per annum.—Anſ. 282l. 2s. 9d.

(7.) Required the intereſt of 420l. for $7\frac{1}{4}$ years, at $3\frac{1}{2}$ per cent. per annum.—Anſ. 106l. 11s. 6d.

(8.) Required the intereſt of 500l. 15s. for $5\frac{1}{2}$ years, at $4\frac{1}{4}$ per cent per annum.—Anſ. 117l. 0s. $11\frac{1}{4}$d.

(9.) Required the intereſt of 97l. 18s. 6d. for $3\frac{3}{4}$ years, at $4\frac{3}{4}$ per cent. per annum.—Anſ. 17l. 8s. $9\frac{3}{4}$d.

PROPOSITION II.

To find the Intereſt of any Sum of Money, having the Principal, the Time of its Continuance in Days, and the Rate per Cent. given.

Rule. As 365 days are to the intereſt of the given ſum for a year, ſo are the days given to the intereſt required.

Or, reduce the principal into the loweſt denomination contained in it, then multiply it by the number of days, and *that* product

product by the rate per cent. for a dividend: let this dividend be divided by 36500, and the quotient will be the answer in the same denomination as the principal was reduced to.

Note. If the interest of a sum of money is required for any number of weeks, reduce them into days, and proceed as above.

(10.) Required the interest of 357l. 10s. for 65 days, at 5 per cent. per annum.

The interest for 1 year, by the first example, is 17l. 17s. 6d.
Then, as 365 days : 17l. 17s. 6d. :: 65 days to 3l. 3s. $7\frac{1}{4}$d. $\frac{6}{73}$.

I presume, by this time, the scholar knows how to work out a stating in the Rule of Three, for which reason I have only stated the question, and adjoined the answer.

Or thus,

The principal reduced, to the lowest term mentioned in it, is 7150 sh. which multiply by 5, the rate per cent. and then by 65, the number of days, and the last product will be 2323750 sh. for a dividend, which divide by 36500, after the manner of compound division, and the quotient will be 63s. $7\frac{1}{4}$d. $\frac{6}{73}$, or 3l. 3s. $7\frac{1}{4}$d. $\frac{6}{73}$. as above.

(11.) Required the interest of 194l. 11s. 6d. for 315 days, at $4\frac{1}{2}$ per cent. per annum.—Ans. 7l. 11s. $1\frac{1}{2}$d.

(12.) What is the interest of 700l. for 149 days, at $4\frac{3}{4}$ per cent. per annum?—Ans. 13l. 11s. $5\frac{1}{2}$d.

(13.) Required the interest of 494l. 12s. 10d. for 29 weeks, at 5 per cent. per annum.—Ans. 13l. 15s. 10d.

(14.) Required the interest of 347l. 10s. for 18 weeks, at 4 per cent. per annum.—Ans. 4l. 16s. $2\frac{3}{4}$d.

(15.) Required the interest of 540l. 10s. from January 1, 1791, to Sept. 22, in the same year, at 4 per cent. per annum?—Ans. 15l. 12s. $8\frac{3}{4}$d.

(16.) What is the interest due on an Exchequer-Bill of 400l. value, at $3\frac{1}{2}$ per cent. per annum, for $2\frac{1}{2}$ years and 59 days?—Ans. 37l. 5s. $10\frac{1}{2}$d.

(17.) Required the interest due upon an Exchequer-Bill of 100l. value, for 294 days, reckoning the interest at 3d. per day.—Ans. 3l. 13s. 6d.

PROPOSITION III.

To find the Interest of any Sum of Money, having the Principal; the Time of its Continuance in Years and Months, or Years, Months, and Days; and the Rate per Cent. given.

Rule. Find the interest for the years by the first Rule, work for the months by the aliquot parts of a year, and for the days by the aliquot parts of a month.

Note. Though the rule to Prop. 3. be not precisely accurate, yet it will be found not less useful than the others which are so; for, in some cases, it is customary to consider the time elapsed different ways. Thus, in the courts of law, interest is always calculated in years, quarters, and days; but, in calculating the interest on the public bonds of the South-Sea and India Companies, and in the Bank of England, &c. the time is generally taken in calendar-months and days; and on Exchequer bills in quarters of a year and days.

(18.) Required the interest of 342l. 10s. for 3 years, 4 months and 15 days, at 4 per cent. per annum.

342l. 10s.		4m.	$\frac{1}{3}$	13l. 14s.	interest for 1 year.
4				3	
13|70	0			41 2	interest for 3 years.
20		15d.	$\frac{1}{8}$	4 11 4	interest for 4 months.
14|00				11 5	interest for 15 days.
				46 4 9	answer.

(19.) Required the interest of 500 guineas for 5 years, 9 months, and 27 days, at $4\frac{3}{4}$ per cent. per annum.—Ans. 145l. 5s. $2\frac{1}{2}$d.

(20.) What is the interest due upon an India Bond of 500l. value, at $3\frac{3}{4}$ per cent. per annum, from May 15, 1791, to September 22, 1793?—Ans. 44l. 5s. 5d.

(21.) Sold an India Bond, of 100l. value, with interest due thereon, for 2 months, 17 days, at 4 per cent. per annum, premium 10s. what is its value?—Ans. 101l. 7s. $1\frac{1}{4}$d.

(22.) A gentleman left his daughter, by will, 875l. 10s. to be paid her when she is 21 years of age, with interest at 5 per cent. per annum. Now she was 18y 7m 3d old at her father's decease, reckoning 12 months to a year, and 30 days to a month. Pray what will be the amount of the fortune when she comes of age?—Ans. 980l. 18s. $5\frac{3}{4}$d.

PROPOSITION IV.

When the Amount, Time, and Rate per Cent. are given to find the Principal.

Rule. As the amount of £100, at the rate and for the time given, is to £100, so is the amount given to the principal.

(23.) What principal, put to interest for 7 years at 5 per cent. per annum, will amount to 465l. 8s. 3d.?

51. in-

5l. intereſt of 100l. for 1 year.
7 time.

35 intereſt of 100l. for 7 years.
100

135 amount of 100l. at 5 per cent. per annum, for 7 years.

As 135l. : 100l. :: 465l. 8s. 3d. to 344l. 15s. anſwer.

(24.) What principal, put to intereſt for 5 years, will amount to 570l. 16s. 6d. at 4 per cent. per annum?—Anſ. 475l. 13s. 9d.

(25.) What principal, put to intereſt for $3\frac{3}{4}$ years, at $4\frac{1}{2}$ per cent. per annum, will amount to 205l. 11s. $7\frac{3}{4}$d. $\frac{4}{5}$?—Anſ. 175l. 18s.

(26.) What principal, put to intereſt for $4\frac{1}{2}$ years, will amount to 350l. 12s. 6d. at $3\frac{3}{4}$ per cent. per annum?—Anſ. 300l.

PROPOSITION V.

When the Amount, Principal, and Time, are given to find the Rate per Cent.

Rule. As the principal is to its intereſt, for the whole time, ſo is £100 to its intereſt for the ſame time; divide this intereſt by the time, and the quotient will be the rate per cent.

(27.) At what rate per cent. will 475l. 13s. 9d. amount to 570l. 16s. 6d. in 5 years time?

570l. 16s. 6d. amount.
475 13 9 principal.

95 2 9 intereſt.

As 475l. 13s. 9d. : 95l. 2s. 9d. :: 100l. to 20l.

This 20l. divided by 5, the number of years, gives 4l. the rate per cent.

(28.) At what rate per cent. will 344l. 15s. amount to 465l. 8s. 3d. in 7 years time?—Anſ. 4 per cent.

(29.) At what rate per cent. will 175l 18s. amount to 205l. 11s. $7\frac{3}{4}$d. $\frac{4}{5}$ in $3\frac{3}{4}$ years?—Anſ. 4l. 10s. per cent.

(30.) At what rate per cent. will 300l. amount to 350l. 12s. 6d. in $4\frac{1}{2}$ years?—Anſ. 3l. 15s. per cent.

PRO-

PROPOSITION VI.

When the Principal, Rate per Cent. and Amount, are given to find the Time.

Rule. As the intereſt of the principal for one year, at the given Rate, is to one year, ſo is the whole intereſt to the time required.

(31.) In what time will 344l. 15s. amount to 465l. 8s. 3d. at 5 per cent. per annum?

344l. 15s. principal.	465l. 8s. 3d. amount.
5 rate per cent.	344 15 0 principal.
£17|23 15	120 13 3 whole intereſt.
20	
s.4|75	
12	
d.9|00	

As 17l. 4s. 9d. : 1 year :: 120l. 13s 3d. to 7 years, anſw.

(32.) In what time will 475l. 13s. 9d. amount to 570l. 16s. 6d. at 4 per cent. per annum?—Anſ. 5 years.

(33.) In what time will 175l. 18s. amount to 205l. 11s. $7\frac{3}{4}$d. $\frac{4}{5}$, at $4\frac{1}{2}$ per cent. per annum?—Anſ. $3\frac{3}{4}$ years.

(34.) In what time will 300l. amount to 350l. 12s. 6d. at $3\frac{3}{4}$ per cent. per annum?—Anſ. $4\frac{1}{2}$ years.

(§. 5.) BROKAGE, or *Brokerage*.

Definition. *Brokage* is an allowance of ſo much *per cent.* made to perſons called Brokers; who, from their knowledge of merchants and the different branches of commerce, are generally employed in buying or ſelling goods for others.

PROPOSITION I.

To find what Allowance muſt be made to a Broker for buying or ſelling Goods, having the Rate per Cent. and Value of the Goods, &c. given.

Rule. Divide the given ſum by 100, and take parts from the quotient with the rate per cent.

Note.

Note. The allowances made to brokers are generally at 2s. or 2s. 6d. per cent. but, ſhould the brokage ſo far accumulate, from repeated negociations, as to exceed 20s. per cent. it muſt be calculated by the following rule of commiſſion.

(1.) Suppoſe I employ a broker to ſell goods for me to the amount of 715l. 15s. what is his allowance at 3s. 9d. per cent.?

l.	s.
£7 | 15	15
20	
s. 3 | 15	
12	
d. 1 | 80	
4	
f 3 | 20	

	l.	s.	d.	
2 6 ½	7	3	1¼	·2
1 3 ¼		17	10½	·9
		8	11¼	·45
	£1	6	10	·35 answer.

Or thus,

As 100l. : 3s. 6d. :: 715l. 15s. : 1l. 6s. 10d. $\frac{7}{20}$ anſwer.

(2.) When a broker ſells goods to the amount of 7134l. 15s. 10d. what may he demand for brokerage, if he is allowed 5s. 9d. per cent?—Anſ. 20l. 10s. 3d.

(3.) Suppoſe I employ a broker to ſell goods for me to the amount of 1057l. 17s. what may he demand for brokerage, if I allow him 4s. 7d. per cent?—Anſ. 2l. 8s. 5¾d.

(4.) What is the brokerage of 3759l. 17s. 6d. at 19s. 9¾d. per cent?—Anſ. 37l. 4s. 11¼d.

(5.) If a broker ſells goods to the value of 750l. 19s. at an allowance of ⅛l. per cent. how much is due to him?—Anſ. 4l. 13s. 10¼d.

(6.) Required the brokerage of 2947l. 15s. d. at ⅜l. per cent.—Anſ. 11l. 1s. 0¾d.

(§. 6.) COMMISSION.

Definition. *Commiſſion* is an allowance made by Merchants to their factors, or agents, in foreign countries, for buying or ſelling goods; and is generally at a certain rate per cent. according to the cuſtom of the country where the factors reſide.

PROPO-

PROPOSITION.

To find what Allowance muſt be made to a Factor at any Rate per Cent. having the Sum given, from which his Commiſſion is to be taken.

Rule. Multiply the ſum by the rate per cent. the product, divided by 100, will give the commiſſion.

Note. If the rate per cent. be leſs than 20s. proceed by the laſt rule.

(1.) If I empower my factor to purchaſe goods for me to the amount of 500l. 14s. what does his commiſſion come to at $2\frac{1}{2}$ per cent?

500l. 14s.
$2\frac{1}{2}$

1001 8
250 7

l. 12|51 15
20

s. 10|35
12

d. 4|20

Anſwer 12l. 10s. $4\frac{1}{5}$ d.

Or thus,

£ $2\frac{1}{2}$ | $\frac{1}{40}$ | 500l. 14s.

£ 12 10 $4\frac{2}{5}$

Or,

If 100l. : 2l. 10s. :: 500l. 14s. to 12l. 10s. $4\frac{2}{5}$ d. anſwer.

(2.) My factor informs me that he has bought goods, on my account, to the amount of 757l. 14s. what comes his commiſſion to at $3\frac{1}{2}$l. per cent?—Anſ. 28l. 8s. $3\frac{1}{4}$d.

(3.) My factor informs me that he has ſold goods on my account to the amount of 500l. 17s. what comes his commiſſion to at $1\frac{3}{4}$ per cent?—Anſ. 6l. 17s. $8\frac{3}{4}$d.

(4.) Conſigned goods to my factor, as per invoice, to the amount of 1175l. 14s. what does his commiſſion come to at $4\frac{3}{8}$ per cent?—Anſ. 51l. 8s. $8\frac{3}{4}$d.

(5.) If I allow my factor $7\frac{5}{8}$ per cent. for commiſſion, what may he demand for purchaſing goods for me to the amount of 977l. 18s.?—Anſ. 74l. 11s. $3\frac{1}{2}$d.

(6.) What does the commiſſion of 7497l. 15s. come to at $12\frac{7}{8}$ per cent?—Anſ. 965l. 6s. $8\frac{1}{4}$d.

(§. 7.) INSURANCE.

Definition. *Insurance* is a ſecurity given in conſideration of a premium of ſo much per cent. paid down by the proprietors of goods, &c. to the inſurers, whereby they engage to anſwer for the loſs or damage of ſhips, houſes, goods, &c. by ſtorms, fires, or other accidents.

PROPOSITION.

To find what Premium muſt be given for an Inſurance of Property, to any Amount, at any Rate per Cent.

Rule. Multiply the value of the property by the rate per cent. the product, divided by 100, will give the premium to be paid down. If the rate per cent. be leſs than 20s. divide the value of the property by 100, and take parts from the quotient with the rate per cent.

(1.) What premium muſt be paid for an inſurance of goods to the amount of 500l. 14s. at $2\frac{1}{2}$ per cent?—Anſ. 12l. 10s. $4\frac{1}{5}$d.

This example is the ſame as the firſt in commiſſion, § 6, and muſt be worked in the ſame manner.

(2.) What premium muſt be paid for inſuring goods to the amount of 715l. 15s. at 3s. 9d. per cent?—Anſ. 1l. 6s. 10d.

This example is the ſame as the firſt in Brokerage, and muſt be worked in the ſame manner.

(3.) What premium muſt be given as a pledge for the inſurance of an Eaſt India ſhip and cargo, valued at 47575l. 18s. when the rate of inſurance is $17\frac{7}{8}$ per cent?—Anſ. 8504l. 3s. 10d.

(4.) Shipped off goods for Jamaica to the value of 4794l. 18s. when the rate of inſurance was $11\frac{5}{8}$ per cent. what premium muſt be paid in London for an inſurance to recover the ſaid value in caſe of failure of the voyage?—Anſ. 557l. 8s. $1\frac{1}{2}$

(5.) When the inſurance of goods to a certain port is $15\frac{3}{4}$ per cent. what premium muſt be given as a pledge for the ſecurity of goods to the amount of 7000 guineas?—Anſ. 1157l. 12s. 6d.

(6.) Suppoſe I inſure goods to the amount of 300l. 18s. what premium muſt I pay at the rate of 2s. 6d. per cent?—Anſ. 7s. $6\frac{1}{4}$d.

(7.) My

(7.) My factor at Barbadoes conſigns goods to me, amounting to the value of 579l. 15s. 6d. what premium muſt I pay for an inſurance of thoſe goods at $11\frac{3}{8}$ per cent?—Anſ. 65l. 18s. $11\frac{3}{4}$d.

(§. 8.) PURCHASING of STOCKS.

Definition. *Stock* is a general name for the capitals of our trading companies, and the money borrowed by government, at ſo much per cent. to defray the expences of the nation.

PROPOSITION.

To aſcertain the Value of any Quantity of Stock at any given Rate per Cent.

Rule. If the current-price of the ſtock to be transferred be under par, viz. leſs than £100, multiply the ſtock by the rate per cent. the product, divided by 100, will give the purchaſe. If the price of the ſtock be above par, multiply the quantity to be transferred by ſuch part of the rate per cent. as exceeds 100; divide this product by 100 as before, to which add the given ſtock for the whole purchaſe.

Or, As £100 ſtock is to the rate per cent. or current price, ſo is the ſtock to be transferred to its current value.

(1.) What muſt be given for 750l. 16s. in the 3 per cent. annuities, when $64\frac{3}{8}$l. will buy 100l.?

$\frac{3}{8}$ | 750l. 16s.
8
6006 8
8
48051 4
93 17
£481 | 45 1
20
s. 9 | 01
Anſwer. 481l. $9\frac{1}{100}$s.

Or thus,

As 100l. $64\frac{3}{8}$l. :: 750l. 16s. : 481l. $9\frac{1}{100}$s.

(2.) What is the purchaſe of 540l. 16s. Bank-ſtock, at $112\frac{5}{8}$ per cent?

Here the rate exceeds 100l. by $12\frac{5}{8}$.

540l. 16s.
$12\frac{5}{8}$
6489 12
$\frac{5}{8}$ = 338 0
£68 | 27 12
20
s. 5 | 52
12
d. 6 | 24 = $\frac{6}{25}$.
£68 5 $6\frac{6}{25}$
540 16 0 add.
609 1 $6\frac{6}{25}$ anſwer

Or thus,

As 100l. : $112\frac{5}{8}$l. :: 540l. 16s. : 609l. 1s. $6\frac{6}{25}$d.

(3.) What

(3.) What is the purchaſe of 7575l. 15s. Bank-ſtock, at 125⅝ per cent.?—Anſ. 9517l. 8½d.

(4.) Required the purchaſe of 900l. South-ſea ſtock, at 89¼ per cent.—Anſ. 803l. 5s.

(5.) What muſt be given for 1750l. 18s. 9d. India ſtock, when 196¼l. will purchaſe 100l.?—Anſ. 3453l. 17s. 6½d.

(6.) Bought 5000l. capital ſtock in the 3 per cent. Conſolidated Annuities, and paid brokerage ⅛ per cent. on the capital, what was the purchaſe at 85⅜ per cent.?—Anſ. 4275l.

(7.) What is the value of 759l. 10s. South-ſea old Annuities, at 64¼ per cent. Brokerage ⅛ per cent.?—Anſ. 488l. 18s. 6¾d.

(§. 9.) DISCOUNT.

Definition. *Diſcount*, or *Rebate*, is an allowance made for the payment of any ſum of money before it becomes due: and the preſent worth of any ſum, or debt, is ſuch a ſum as if put to intereſt for the time, and at the rate for which the diſcount is to be made, would amount to the ſum, or debt, due.

PROPOSITION.

Any Sum, due ſome Time hence, being given to find its preſent Value to the Creditor, diſcounting at any Rate per Cent.

Rule. As the amount of £100, for the given rate and time, is to £100, ſo is the given ſum to its preſent worth. The difference between the given ſum and its preſent value will give the diſcount.

Or, as the amount of £100, for the given rate and time, is to the intereſt of £100 for that time, ſo is the given ſum to the diſcount. The difference between the given ſum and its diſcount will give the preſent value.

Note. It is cuſtomary with bankers, in diſcounting bills, to calculate the intereſt of the ſum drawn for, in the bill, from the time of their diſcounting it to the time it becomes due, including the days of grace.—By this practice they make the diſcount more than it ought to be.

When goods are bought or ſold, on which diſcount is to be made for preſent payment at any rate per cent. if no time is ſpecified, the intereſt of the value of the goods for a year is the diſcount.

When goods are ſold to any amount, payable at different times, at the ſame or different rates per cent. calculate the preſent worth of each payment ſeparately, as a debt independent of the other payments, and the ſum of theſe will be the preſent value of the goods to the ſeller.

(1.) What is the preſent worth and diſcount of 550l. 10s. for 9 months, at 5 per cent. per annum?

6m.	$\frac{1}{2}$	£5		intereſt of 100l. for 1 year.
3m.	$\frac{1}{2}$	2	10	ditto for $\frac{1}{2}$ year.
		1	5	ditto for $\frac{1}{4}$ year.
		3	15	ditto for $\frac{3}{4}$ of a year.
		100	0	
		£103	15	amount of 100l. for $\frac{3}{4}$ of a year.

As 103l. 15s. : 100l. :: 550l. 10s. : 530l. 12s. $0\frac{1}{2}$d. $\frac{26}{83}$, the preſent worth; which, deducted from 550l. 10s. gives 19l. 17s. $11\frac{1}{4}$d. $\frac{57}{83}$ for the diſcount.

Or thus,

As 103l. 15s. : 3l. 15s. :: 550l. 10s. : 19l. 17s. $11\frac{1}{4}$d. $\frac{57}{83}$ the diſcount; which, deducted from 550l. 10s. gives 530l. 12s. $0\frac{1}{2}$d. $\frac{26}{83}$ for the preſent worth.

(2.) Required the preſent worth of 594l. 14s. 9d. due 8 months hence, allowing a diſcount of $5\frac{3}{4}$ per cent. per ann. —Anſ. 572l. 15s. $7\frac{1}{4}$d.

(3.) Sold goods to the value of 915l. 17s. payable 7 months hence; what muſt I allow for preſent payment, at 8 per cent. per annum?—Anſ. 40l. 6s. 8d.

(4.) How much ready money ſhould I have for a note of 75l. which would be due 19 months hence, if I allow a diſcount of 5 per cent. per annum?—Anſ. 69l. 9s. $11\frac{1}{2}$d.

(5.) If a legacy of 900l. be left me on the 22d of Sept. to be paid at Chriſtmas, what muſt I receive if I allow 6 per cent. per annum diſcount for preſent payment?—Anſ. 886l. 6s. $2\frac{1138}{9724}$d.

(6.) What is the diſcount of 15000l. for 57 days, at $7\frac{3}{8}$ per cent. per annum?—Anſ. 176l. 9s. $10\frac{5602}{32381}$d.

(7.) A bond, bearing date the 5th of July, 1788, is payable at Midſummer, 1789, valued 1757l. 10s. what preſent money would have diſcharged it at the time it was made, allowing a diſcount of $7\frac{3}{8}$ per cent. per annum?—Anſ. 1640l. 3s. $10\frac{5282}{31433}$d.

(8.) Sold goods to the value of 747l. 18s. one third of which is due immediately, $\frac{1}{3}$ at the end of 7 months, and the reſt

reſt at 10 months; what ready money ought I to receive if I allow a diſcount of $8\frac{5}{8}$ per cent.?—Anſ. 721l. 3s. $2\frac{1}{2}$d.

(9.) Sold goods to the value of 800l. 16s. payable as follows, viz. $\frac{1}{4}$ at 2 months, $\frac{1}{6}$ at 3 months, $\frac{1}{7}$ at 9 months, $\frac{3}{5}$ at 11 months, and the reſt at 12 months; what muſt be diſcounted for preſent payment, at 5 per cent. per annum?—Anſ. 23l. 1s. $10\frac{1}{4}$d.

(10.) What ready money will diſcharge a debt of 1789l. 19s. 10d. due 3 years, 3 quarters, and 41 days hence, diſcount at $5\frac{3}{4}$ per cent. per annum?—Anſ. 1482l. 5s. 7d.

(11.) What difference is there between the intereſt of 1000l. for 20 years, and the diſcount of the ſame ſum for that time, the rate per cent. in each caſe being 5l.?—Anſ. 500l.

(§. 10.) EQUATION of PAYMENTS.

Definition. When ſeveral debts are payable at different times, bearing no intereſt till after the term of payment, the finding a time at which, if they are all paid together, neither the debtor nor the creditor will ſuffer loſs, is called *Equating*, or reducing the times of payment to one.

PROPOSITION.

To find the equated Time at which ſeveral Debts, payable at different times, may be paid at once, without Loſs either to the Debtor or Creditor, allowing ſimple Intereſt.

Rule. Multiply each payment by the time at which it becomes due; then divide the ſum of the products by the ſum of the payments, and the quotient will be the time required.

(1.) A owes B 110l. whereof 50l. is to be paid at 2 years' end, 40l. at $3\frac{1}{2}$ years' end, and 20l. at $4\frac{1}{2}$ years' end; at what time may B receive the whole at once, without prejudice to either party?

50	multiplied by 2	gives	100
40	—— by	$3\frac{1}{2}$ —	140
20	—— by	$4\frac{1}{2}$ —	90
110	sum of the payments.		330 sum of the products.

The 330, divided by 110, gives 3 years, the answer.—If the times of payment, or debts, are of different denominations, they must always be reduced to the same denomination before you attempt to solve a question by the rule.

(2.) A debt of 500l. is to be discharged, viz. 100l. at 2 months, 200l. at 4 months, and the rest at 6 months, what is the equated time for the payment of the whole?—Ans. $4\frac{2}{5}$ months.

(3.) A debt of 700l. is to be discharged thus; £150 present, £300 at 6 months, £200 at 9 months, and the rest at 12 months; what is the equated time for the payment of the whole?—Ans. 6 months.

(4.) A merchant buys goods to the amount of £750, £350 of which is paid at 3 months, and the rest at 9 months:—to prevent farther trouble, it is agreed to pay the whole at once, and to prolong the time of the first payment in proportion to the shortening the time of the second; at what time must the whole be discharged without prejudice to either?—Ans. $6\frac{1}{3}$ months.

(5.) A debt of 500l. 15s. is payable as follows; £150 at 2 months, 147l. 17s. at 74 days, 137l. 18s. at 95 days, and the rest at 5 months. It is to be discharged at one payment; what is the equated time, reckoning 30 days to a month?—Ans. 2m. $25\frac{45533}{100015}$ days.

(6.) A owes B a certain sum, which is to be discharged as follows, viz. $\frac{1}{2}$ at 4 months, $\frac{1}{4}$ at 5 months, $\frac{1}{6}$ at 7 months, and the rest at 10 months. Now, if both parties should agree to have the whole discharged at once, what is the equated time?—Ans. $5\frac{1}{4}$ months.

(7.) A debt is to be discharged thus, $\frac{1}{3}$ present, $\frac{1}{8}$ at 25 days, $\frac{1}{9}$ at 3 months, and the rest at 4m. 17d. what time may the whole be paid at once?—Ans. $85\frac{56}{90}$ days.

(8.) Three legacies are left by a gentleman, in his will, payable by his executors to one person, or his heirs. The first legacy of 500l. 18s. is payable in $\frac{1}{2}$ a year, the 2d of 900l. 17s. 6d. is payable in 1 year, 114 days, and the 3d of 1700l. 18s. $4\frac{3}{4}$d. is payable in $2\frac{1}{2}$ years. The legatee and executors have agreed that the payment of these sums shall be made at once; at what time must that be, that neither party may be injured, allowing simple interest?—Ans. 1 year, 303 days, 2325661$\frac{1}{2}$ rem.

(§. 11.) COM-

(§. 11.) COMPOUND INTEREST.

Definition. Compound Intereſt is that which is produced not only from the ſum of money lent as the principal, but alſo from the intereſt, which, (when unpaid,) as it becomes due, is added to the principal.

PROPOSITION.

To find the Intereſt of any Sum of Money, unpaid, for any equal Number of Payments at any Rate per Cent.

Rule. Find the amount of the given principal for the time of the firſt payment by Simple Intereſt; then conſider this amount as the principal for the ſecond payment, and find *its* amount as before. Proceed thus through all the payments, always conſidering the laſt amount as the principal of the next payment; then, if the given principal or money lent, be deducted from the laſt amount, the remainder will be the intereſt required.

Note. The above rule will be true, whether the payments are made yearly, half-yearly, quarterly, monthly, or by any other aliquot part of a year: thus, for half-yearly payments, take half the rate per cent. and twice the number of years;—for quarterly payments, take ¼ of the rate per cent. and four times the number of years, &c.

(1.) What is the compound intereſt of 357l. 10s. for 3 years, at 5 per cent. per annum?

5l. is $\frac{1}{20}$)	357l.	10s.		principal.
	17	17	6	intereſt for the firſt year.
$\frac{1}{20}$)	375	7	6	amount for ditto.
	18	15	$4\frac{1}{2}$	intereſt for the 2d year.
$\frac{1}{20}$)	394	2	$10\frac{1}{2}$	amount for ditto.
	19	14	$1\frac{1}{2}-\frac{9}{10}$	intereſt for the 3d year.
	413	17	$0-\frac{9}{10}$	amount for ditto.
	357	10	0	principal.

Anſwer £56 7 $0-\frac{9}{10}$ whole intereſt, which is £2 14 $6-\frac{9}{10}$ more than the ſimple intereſt of the ſame ſum. See Example 1, Simple Intereſt.

(2.) What is the compound intereſt of 700l. 18s for 4 years, at 5 per cent. per annum?—Anſ. 151l 0s. 11½d.

(3.) What is the compound intereſt of 1057l. 17s. 6d. for 6 years, at 4 per cent. per annum?—Anſ. 280l. 13s. 5¾d.

(4.) Required the amount of 500l. 17s. for 5 years, at 4¼ per cent. compound intereſt?—Anſ. 616l. 14s 4¾d.

(5.) What will 700l. amount to in 7 years, at 4¾ per cent. per annum, compound intereſt?—Anſ. 968l. 13s. 5d.

(6.) Find the ſeveral amounts of 500l. payable yearly, ½ yearly, and quarterly, being forborne 4 years, at 5 per cent. per annum. Anſwer £607 15 0¾ for yearly, £609 4 0¼ for half-yearly, and £609 18 10½ for quarterly, payments.

(§. 12.) FELLOWSHIP.

Definition. *Fellowſhip* is a general rule by which the accounts of merchants, &c. trading in company, with a joint ſtock, are adjuſted; ſo that every partner may have his due ſhare of the gain, or ſuſtain a proportional part of the loſs, according to the money he has advanced in the ſtock, and the time of its continuance therein.

(§. 13.) SINGLE FELLOWSHIP.

Definition. *Single Fellowſhip* is when different ſtocks are employed for any certain equal time.—The effects of bankrupts are by this rule properly divided among their creditors, legacies adjuſted in deficiencies of aſſets, &c.—It likewiſe teaches us to divide any given number into unequal parts, proportional to certain other given numbers.

PROPOSITION.

Having each Man's particular Stock and the whole Gain or Loſs given to find each Man's Part of the Gain or Loſs.

Rule. As the whole ſtock is to the whole gain or loſs, ſo is each man's particular ſtock to his particular ſhare of the gain or loſs.

Method

Method of Proof. Add all the ſhares together, and the ſum will be equal to the given gain or loſs when the work is right.

(1.) Three merchants, A, B, and C, enter upon a joint adventure; A puts into the common ſtock 250l. 10s. B 300l. 15s. and C 410l. 18s. After all expences were paid, a clear gain of 327l. 11s. 6d. was to be divided amongſt them; what was each merchant's ſhare.

250l.	10s	A's ſtock.
300	15	B's ſtock.
410	18	C's ſtock.
£962	3	ſum, or the whole ſtock.

	l.	s.		l.	s.	d.		l.	s.	d.	rem.
As	962	3	:	327	11	6	::	250	10	:	85 5 8½ — 3338, A's ſhare.
	962	3	:	327	11	6	::	300	15	:	102 7 10½ — 666, B's ſhare.
	962	3	:	327	11	6	::	410	18	:	139 17 10½ — 15239, C's ſh.
											327 11 6 proof.

(2.) Two merchants trade together; A put into the ſtock 500l. 17s. 10d. and B 700 guineas; they gained 300l. 15s. what is each perſon's ſhare thereof?—Anſ. A's ſhare 121l. 17s. 9½d. rem. 195484; and B's ſhare 178l. 17s. 2¼d. rem. 101130.

(3.) Four merchants, A, B, C, and D, entered into partnerſhip with a ſtock of 5075l. 18s. of which A contributed 574l. 16s. B 947l. 18s. 6d. C 3044l. 17s. and D the reſt; they gained 1358l. 18s. what was each merchant's ſhare thereof in proportion to his ſtock?—

	£.	s.	d.	rem.	
Anſwer.	153	17	7¾	88238	A's ſhare.
	253	15	5¼	77710	B's. —
	815	3	1¼	6586	C's. —
	136	1	8¾	30502	D's. —

(4.) The money and effects of a bankrupt, after every unavoidable expence is deducted, amount to 7174l. 14s. At this time he is indebted to A 540l. 14s. to B 770l. 18s. to C 4005l. 14s. to D 975l. 18s. 9d. and to E 3000 guineas, how muſt it be

be divided amongſt them, and what will they receive in the pound?

	£.	s.	d.		
Anſwer.	410	16	1¾	A's ſhare.	And 15s. 2¼d. per £.
	585	14	1¾	B's —	
	3043	8	3½	C's —	
	741	9	9¼	D's —	
	2393	5	7	E's —	

*(5.) A merchant in the Weſt Indies having amaſſed a great fortune by trade, beſides a number of bequeſts, left the following legacies to four of his indigent relations, viz. to A 1070l. to B 1380l. to C. 1260l. and to D 1650l. and moreover ordered by his will that if any ſurplus of his effects remained after diſcharging theſe, and all his other legacies, it ſhould be divided in proportion to theſe ſums amongſt the ſaid four perſons It happened that his reſiduary effects amounted to 29480l. how muſt this ſum be divided amongſt them?—Anſ. A muſt have 5885l. B 7590l. C 6930l. and D 9075l.

(6.) Three merchants, A, B, and C, freight a ſhip with wine; A put on board 500 tuns, B 340, and C 94; by a ſtorm at ſea they were obliged to caſt 150 tuns over board; what loſs does each ſuſtain?—Anſ.

t.	hhd.	gal.	rem.
80	1	12	510 A's loſs.
54	2	26	160 B's —
15	0	24	264 C's —

(7.) Let the number 1680 be divided into 6 ſuch parts as ſhall be to each other as 1, 2, 3, 4, 5, and 6, reſpectively? Anſ. 80, 160, 240, 320, 400, 480.

(8.) Three merchants enter into a partnerſhip with a ſtock of 1789l. 4s. their ſeveral ſtocks are in proportion as 7, 8, and 9; they gained 500l. required each perſon's ſtock and gain?—Anſ.

Their ſeveral ſtocks.	521	17		Their ſeparate gain.	145	16	8
	596	8			166	13	4
	670	19			187	10	0

(9.) There was a mixture of 3 different kinds of wine, in which, for every three gallons of one kind, there was four of another, and 7 of a third; what quantity of each kind is in a mixture of 292 gallons?—Anſ. 62⅔, 83⅓ and 146 gal.

(10.) A father left his eſtate of 19090l. among 3 ſons, in ſuch manner, that, for every 2l. that A gets, B ſhall have 3, and C 5; how is the eſtate divided?—Anſ. A's part 3818l. B's 5727, C's 9545.

(§. 14.) DOU-

(§. 14.) DOUBLE FELLOWSHIP.

Definition. *Double Fellowſhip* is that which ſuppoſes the ſeveral ſtocks, advanced for the purpoſes of trade, to be continued for unequal times, or to be increaſed or diminiſhed at pleaſure, with the conſent of the ſeveral partners, at any time during the continuance of ſuch partnerſhip.

PROPOSITION.

Given each Man's Stock, the Time of its Continuance, and the whole Gain or Loſs, to find each Man's Part of the Gain or Loſs.

Rule. Multiply each man's ſtock by the time of its continuance. Then, as the ſum of all the products is to the whole gain or loſs, ſo is each man's product to his part of the gain or loſs.

Method of Proof as in Single Fellowſhip.

(1.) Three merchants, A, B, and C, enter into partnerſhip; A puts in 89l. 5s. for 5 months, B 92l. 15s. for 7 months, and C 38l. 10s. for 11 months: with this ſtock they traffic, and gain 86l. 16s. required each perſon's ſhare of the gain in proportion to his ſtock, and the time of its continuance.

89l. 5s.	multiplied by 5	gives	446l. 5s.	A's product.
92 15	——	by 7	— 649 5	B's product.
38 10	——	by 11	— 423 10	C's product.
		Sum of the products	1519 0	

	l.		l. s.		l. s.		l. s.	
As	1519	:	86 16	::	446 5	:	25 10	A's gain.
	1519	:	86 16	::	649 5	:	37 2	B's gain.
	1519	:	86 16	::	423 10	:	24 4	C's gain.
							£86 16	proof.

(2.) Three merchants, A, B, and C, engage in partnerſhip; A puts in 547l. 19s. 6d. for 7 months, B 475l. 18s. for 9 months, and C 1747l. 14s. for four months; they trade, and gain 225l. Required each perſon's ſhare thereof?

£.	s.	d.		rem.	
57	2	4½	——	2769444	A's ſhare.
63	15	7	——	2725848	B's —
104	2	0	——	1757376	C's —

(3) Four

(3.) Four farmers, A, B, C, and D, jointly hired a paſture of a neighbour for 20 guineas, into which A turned 7 oxen for 13 days, B 9 oxen for 14 days, C 11 oxen for 25 days, and D 15 oxen for 37 days; how much muſt each farmer pay for his ſhare of the paſture?—Anſ.

£.	s.	d.			
1	16	6	—	216	A's ſhare.
2	10	$6\frac{1}{2}$	—	138	B's —
5	10	$3\frac{3}{4}$	—	135	C's —
11	2	$7\frac{1}{2}$	—	558	D's —

(4.) A family of 10 perſons took a large houſe for $\frac{1}{2}$ a year, for which they were to pay 26l. 2s. 6d. for that time. Now, at the end of 14 weeks, they took in 4 lodgers, and 3 weeks after four more; and ſo on for every 3 weeks (during the term) they took in 4 more lodgers. What muſt one of each claſs pay per week of the rent?—Anſ. each lodger muſt pay 1s. $4\frac{1}{2}$d. per week.

	£.	s.	d.
The family muſt pay	17	17	6
The firſt four lodgers	3	6	0
The ſecond four	2	9	6
The third four	1	13	0
The laſt four	0	16	6

(5.) Three merchants enter into partnerſhip, and trade as follows; A put in 150l. and at the end of 7 months took out 50l; 5 months after that he put in 170l:—B put in 205l. and at the end of 5 months 110l. more, but took out 150l. four months after:—C put in 300 guineas, and, when 6 months had elapſed, he drew out 150l. but 9 months after he put in 500l.;—their partnerſhip continued 18 months, at the end of which time they gained 450l. Required each perſon's ſhare thereof?—Anſ.

£.	s.	d.		rem.	
115	17	$7\frac{1}{2}$	—	1740	A's ſhare.
137	16	$3\frac{1}{2}$	—	2380	B's —
196	6	$0\frac{3}{4}$	—	8190	C's —

*(6.) Four perſons hired a coach, to go 50 miles, for 40s. now when they had gone 20 miles, they overtook two perſons who deſired to come into the coach, with condition to pay proportionably; how much muſt each of them pay?—Anſ. the four firſt perſons muſt each pay 7s. $8\frac{4}{13}$d. and the two laſt each 4s. $7\frac{5}{13}$d.

(§. 15.) LOSS

(§. 15.) LOSS and GAIN.

Definition. *Loſs and Gain* is a rule that diſcovers what is gained or loſt in the buying or ſelling of goods; and inſtructs the merchant, or trader, to raiſe or lower the price of his goods ſo as to gain or loſe ſo much per cent. &c.

PROPOSITION I.

Given the prime Coſt and ſelling Price of an Integer of any Quantity of Goods, to find the whole Gain or Loſs.

Rule. Calculate the value of the goods, at the prime coſt and ſelling price of an integer, by the Rule of Three or Practice, and the difference of the values will be the gain or loſs.

(1.) Bought 119¾cwt. of ſugar at 1l. 15s. per cwt. whether ſhall I gain or loſe if I ſell it by retail for 6d. per lb.?

If 1cwt. : 1l. 15s. :: 119¾cwt. : 209l. 11s. 3d. prime coſt.
If 1lb. : 6d. :: 119¾cwt. : 335l. 6s. ſold for.

Then 335l. 6s.—209l. 11s. 3d.=125l. 14s. 9d. gain.

(2.) Bought 15cwt. of cheeſe at 1l. 11s. 6d. per cwt. which I ſell by retail at 4½d. per lb. what ſhall I gain or loſe by ſo doing?—Anſ. 7l. 17s. 6d.

(3.) If I buy 240 eggs, viz. ½ at 3 for a penny, and the other ½ at 2 for a penny, whether ſhall I gain or loſe if I mix them together, and ſell them 5 for 2 pence?—Anſ. 4d. loſs.

(4.) A merchant bought 12 tuns of wine at 75l. 12s. per tun, which he ſold at 7s. per gallon; but, by misfortune, a pipe was ſtaved, and rendered unſaleable. Whether did the merchant gain or loſe, and how much by ſuch ſale?—Anſ. 107l. 2s. gain.

(5.) Bought 340 yds of cloth at 5s. 4d. a yard, and ſold it again at 7s. 6d. per yard, what did I gain in the whole?—Anſ. 36l. 16s. 8d. whole gain.

PROPOSITION II.

Given the prime Coſt and ſelling Price of an Integer of any Quantity of Goods to find the Gain or Loſs per Cent.

Rule. As the prime coſt of an integer is to 100l. ſo is the advanced or reduced price of ſuch integer to a fourth number; which, if greater than 100l. the exceſs will be the gain; but, if leſs than 100l. the defect will be the loſs, per cent.

(6.) If

(6.) If wine is bought at 7s. 6d. per gallon, and ſold for 10s. what is gained per cent. by ſuch ſale?

If 7s. 6d. : 100l. :: 10s. : 133l. 6s. 8d.
Then 133l. 6s. 8d.—100l.=33l. 6s. 8d. the gain per Cent.

(7.) A merchant has a quantity of damaged tobacco, which, including all expences, ſtands him in $17\frac{1}{4}$d. per lb. what will he loſe per cent. by a ſale at $13\frac{1}{2}$d. per lb.?—Anſ. 21l. 14s. $9\frac{3}{4}$d. $\frac{13}{23}$ loſs per cent.

(8.) Bought 27 yards of cloth for 17 guineas, and ſold them again at 9s. 10d. per yard; what was the gain or loſs per cent.?—Anſ. 25l. 12s. $7\frac{1}{4}\frac{1}{19}$ loſs per cent.

(9.) Bought a quantity of goods for 60l. and ſold them again for 75l. what was the gain per cent.?—Anſ. 25l. per cent.

(10.) Bought a quantity of cloth at 7s. 6d. per yard, which, upon examination, I find not ſo good as I expected. Now, if I ſell it at 6s. $2\frac{1}{4}$d. per yard, what ſhall I loſe per cent. by it?—Anſ. 17l. 10s. loſs per cent.

PROPOSITION III.

Given the prime Coſt of an Integer, and the propoſed Gain or Loſs per Cent. to find the ſelling Price of ſuch Integer.

Rule. As 100l. is to 100l. with the gain added to, or the loſs ſubtracted from it, ſo is the prime coſt of an integer to the required price per integer.

(11.) Bought muſlin at 4s. 8d. per yard; at what price muſt I ſell it per yard to gain $12\frac{1}{2}$ per cent.?

If 100l. : 112l. 10s. :: 4s. 8d. : 5s. 3d. anſwer.

(12.) If I buy cloth at 11s. 6d. per yard, how muſt I ſell it to gain 20l. per cent.?—Anſ. 13s. $9\frac{1}{5}$d. $\frac{2}{5}$ per yard.

(13.) A Mancheſter man bought a quantity of yarn at 6s. per bundle, which not proving ſo good as he expected, he ſold it ſo as to loſe 6l. per cent. by it; what was the ſelling price?—Anſ. 5s. $7\frac{1}{5}$d. $\frac{18}{25}$ per bundle.

(14.) If I buy tobacco at 12 guineas per cwt. at what rate muſt I ſell it per lb. to gain 15l. per cent.?—Anſ. 14l. 9s. $9\frac{1}{2}$d. $\frac{2}{5}$ per cwt.

(15.) Bought a quantity of cloth at 7s. 6d. per yard, which not proving ſo good as I expected, I have reſolved to loſe $17\frac{1}{2}$l. per cent. by it; how muſt I ſell it per yd.?—Anſ. 6s. $2\frac{1}{4}$d. per yard.

PRO-

Proposition IV.

Given the Price of an Integer, with the Gain or Loſs per Cent. by ſuch a Price, to find the Gain or Loſs at any other Price.

Rule. As the given price of an integer is to 100l. with the gain per cent. added to, or loſs ſubtracted from, it, ſo is the propoſed price to a fourth number. If this fourth number be greater than 100l. the exceſs will be the gain; but, if it be leſs, take it from 100l. and the remainder will be the loſs per cent.

(16.) A ſtationer ſold quills at 11s. per thouſand, by which he cleared 60l. per cent. but, they growing ſcarce, he raiſed them to 13s. 6d. per thouſand; what was his gain per cent. by the latter price?

If 11s. : 160l. :: 13s. 6d. : 196l. 7s. $3\frac{3}{11}$ d
Then 196l. 7s. $3\frac{3}{11}$d.—100l.=96l. 7s. $39\frac{3}{11}$. anſwer.

(17.) If, when I ſell cloth at 8s. 9d. per yard, I gain 12l. per cent what will be the gain per cent when it is ldfor 10s. 6d. per yard?—Anſ. 34l. 8s. gain per cent.

(18.) A woollen-draper in London had a quantity of black cloth by him, and, being afraid of its being damaged, he ſold it at 15s. per yard, and by ſo doing loſt 14l. per cent. but, a general mourning coming unexpectedly, he was enabled to advance his cloth to a guinea per yard; what did he gain or loſe per cent. by the latter ſale?—Anſ. 20l. 8s. gain per cent.

(19.) If a plumber gains 12l. 10s. per cent. when lead is ſold at 20l. 9s. 6d. a fother, what would he gain or loſe per cent. when it is ſold only at 17l. 1s. 3d. the fother?—Anſ. 6l. 5s. loſs per cent.

Proposition V.

Given the Price at which an Integer of any Quantity of Goods is ſold, and the Gain or Loſs per Cent. by ſuch Sale, to find the whole Gain or Loſs.

Rule. Find the whole value of the goods at the ſelling price per integer. Then, as 100l. with the gain per cent. added to, or loſs ſubtracted from it, is to 100l. ſo is the whole value at which the goods were ſold to the whole prime coſt. The difference between the whole value at which the goods were ſold and the whole prime coſt will give the whole gain or loſs.

(20.) A merchant ſold 5t. 3hhds 53½gal. of wine at 6s. 8d. per gallon, and by ſo doing gained 6½l. per cent. what was the prime coſt of his wine, and what did he gain in the whole?

If 1 gal. : 6s 8d. :: 5t. 3hhd. 53½g. : 500l. 16s. 8d. ſold for.
Again, if 106l. 10s. : 100l. :: 500l. 16s. 8d. : 470l. 5s. $3\frac{1}{2}\frac{8}{1}\frac{1}{3}$d. prime coſt.

Then 500l. 16s. 8d.—470l. 5s. $3\frac{1}{2}\frac{1}{8}\frac{1}{3}$d.=30l. 11s. $4\frac{3}{2}\frac{2}{1}\frac{2}{3}$d. whole gain.

(21.) A merchant ſold 15cwt. 3qr. 18lb. of ſugar at 7½d. per lb. and his profit per cent. was 25l. what did he gain in the whole?—Anſ. 11l. 2s. 9d.

(22.) If I ſell 500 deals at 15d. a piece, and 9l. per cent. loſs, what do I loſe in the whole quantity?—Anſ. 3l. 1s. 9¾d. $\frac{3}{91}$ whole loſs.

(23.) A had 15 pipes of Malaga wine, which he parted with to B at 4⅓l. per cent. profit, who ſold them to C for 38l. 11s. 6d. advantage; C made them over to D for 500l. 16s. 8d. and cleared thereby 6½ per cent. what did this wine coſt A per gallon?—Anſ. 4s. 4½d.

PROPOSITION VI.

Given the prime Coſt of an Integer of any Quantity of Goods, and the Gain or Loſs per Cent. by the whole Quantity, to find the whole Gain or Loſs.

Rule. Find the whole value of the goods at the prime coſt per integer. Then, as 100l. is to 100l. with the gain added to, or loſs ſubtracted from it, ſo is the whole value of the goods, at the price they coſt, to the whole value at the gain or loſs per cent. propoſed. The difference between theſe values will give the whole gain or loſs.

(24.) Bought 60 reams of paper at 15s. per ream, by the ſale of which I loſt 4l. per cent. what did I loſe in the whole?

If 1r. : 15s. : 60r. : 45l. prime coſt.
If 100 : 96 :: 45l. : 43l. 4s. ſelling price.
Then 45l.—43l. 4s.=1l. 16s. whole loſs.

(25.) Sold 7 pieces of cloth, each containing 35½ yards, on account of damage, at a loſs of 10l. per cent. what did I loſe in the whole, the prime coſt being 15s. per yard?—Anſ. 18l. 12s. 9d.

(26.) Bought 475 yards of cloth at 10s. 6d. per yd. by which I gained 30l. per cent. what did I gain in the whole? —Anſ. 74l. 16s. 3d.

(§. 16.) BARTER.

Definition. When merchants or tradeſmen exchange one commodity for another, it is called *Bartering*; and, by the rule of proportion, the price and quantity of the goods ſo exchanged are determined, ſo that neither party may ſuſtain a loſs by ſuch traffic.

Proposition I.

Given the Price of an Integer of any Quantity of Goods to find the correſponding Quantity of any other Sort of Goods at any given Price per Integer.

Rule. Find the value of that commodity, whereof the quantity is given, by the Rule of Three or Practice. Then, as the price of an integer of the required quantity of goods is to that integer, ſo is the value of the given quantity, found before, to the required quantity.

(1.) A and B barter; A has $3\frac{1}{2}$lb. of pepper at $13\frac{1}{2}$d. per lb. B has ginger at $15\frac{1}{4}$d. per lb. how much ginger muſt B give for A's pepper?

$\frac{1}{2}$	1s. $1\frac{1}{2}$d.	value of 1lb. of A's pepper.
	3	
3	$4\frac{1}{2}$	value of 3lb.
	$6\frac{3}{4}$	ditto of $\frac{1}{2}$lb.
3	$11\frac{1}{4}$	ditto of $3\frac{1}{2}$lb.

Then, as $15\frac{1}{4}$d. : 1lb. :: 3s. $11\frac{1}{4}$d. : 3lb. $12\frac{3}{61}$oz. anſwer.

(2.) A would exchange 400 gallons of Jamaica rum, worth 7s. 9d. per gallon, with B for London porter, at 9d a gallon; how many gallons of porter muſt A receive of B in exchange for his rum?—Anſ. $4133\frac{1}{3}$ gal.

(3.) A hop-factor, A, exchanged 5cwt 1qr 10lb of hops, at 2s. $4\frac{1}{2}$d. per lb. for wheat at 5s. 9d. per buſhel, with a farmer, B; what quantity of wheat did B give A for his hops?—Anſ. 244 $\frac{115}{138}$ buſh.

(4.) How many yards of cloth, at 18s. 6d. per yard, muſt I give for 5000 yards of baize, at $13\frac{1}{2}$d. per yard?—Anſ. 304 $\frac{2}{37}$ yds.

(5.) A delivered 6 hhds of brandy, at 6s. 8d. per gallon, to B for 252 yards of cloth; what ought the cloth to be worth per yard?—Anſ. 10s.

(6.) A has 288 ells of cloth, worth 1s. 3d. per ell, which he would barter with B for cheeſe at 19s. per cwt. what weight of cheeſe ought B to give for the cloth?—Anſ. 18cwt 3qr 22 $\frac{2}{19}$lb.

(7.) A and B bartered; A had 14cwt 3qrs of ſugar, worth 1l. 17s. per cwt. which he bartered for wine worth 3s. 9d. per gallon; how much wine did A receive?—Anſ. 145 $\frac{5}{7}$ gals.

(8.) A chandler and butcher trade as follows; the butcher has 3cwt 2qr 16lb of tallow at 1l. 17s. 4d. per cwt. and the chandler rates his candles at 5s. 2d. per dozen. How many lbs of candles muſt the chandler give the butcher for his tallow?—Anſ. 315 $\frac{27}{31}$.

Proposition II.

Given the Price of an Integer of any Quantity of Goods to find the Quantity of any other Kind of Goods, (at any given Price per Integer,) when Part of the Value is paid in Money or any other Kind of Merchandiſe.

Rule. Find the whole value of that commodity, whereof the quantity is given, by the Rule of Three or Practice; from which ſubtract the ſum of money to be paid down, or the value of the given quantity of goods in exchange. Then, as the price of an integer, of the required quantity of goods, is to that integer, ſo is the remaining value to be accounted for to the required quantity.

(9.) A and B barter as follows; A has 41 cwt. of hops at 30s. per cwt. for which B gives him 20l. in ready money, and the reſt in ſugar at 6d per lb. What quantity of ſugar muſt B give A?

10s. | ½ | 41l.
20 10 As 6d. : 1lb. :: 41l. 10s. : 14cwt. 3qr. 8lb. answer.

61 10 Value of A's hops.
20 0 paid down.

41 10 to account for.

(10.) A and B barter; A has 750 yards of canvas, worth 10d. per yard, for which B gives him 475 yards of ſerge at 11½d. per yard, and the balance in cotton as 3s. per yard; how many yards of cotton muſt A receive?

½d. | 1/24 | 475
19 9½

20)455 2½

£22 15 2½

10d. | 1/24 | 750

£31 5 value of A's canvas.
22 15 2½ value of B's ſerge.

£8 9 9½ to account for.

As 3s. : 1yd :: 8l. 9s. 9½d. : 56yds 2 7/8 qrs. anſwer.

(11.) A has 700 gallons of rum at 4s. 6d. per gallon, for which B gives him 27 guineas in money, and the reſt in cotton at 11½d. per lb. how much cotton muſt A receive?—Anſ. 2695 7/23 lb.

(12.) A has 57qrs 6buſh of corn, worth 1l. 11s. 6d. per quarter, for which B will give 14cwt 3qr 18lb of ſugar at 4l. 14s. per cwt. and the balance in raiſins at 7d. per lb. Should theſe perſons barter, what quantity of raiſins ought B to give A?—Anſ. 715l. 7/8 lb.

(13.) A has 27cwt of cheeſe, worth 1l. 11s. 4d. per cwt. and B has 25 pieces of cloth, worth 1l. 19s. 10½d. per piece; ſhould theſe perſons barter together, to whom will the balance, if any, be due?—Anſ. Balance due to B. 7l. 10s. 10½d.

(14.) xvii. A and B barter; A has 24 puncheons of rum, worth 4s. 9d. per gallon; for which B gives him 150 guineas in caſh, and 714 yards of cloth. What ought B's cloth to be worth per yard?—Anſ. 9s.

(§. 17.) EXCHANGE.

Definition 1. By *Exchange* is meant the bartering, or exchanging, the money of one place for that of another, by means of an inſtrument in writing, called a *Bill of Exchange*;

and consists in finding what quantity of the money of one city or country will be equal to any given sum of another, according to a given course of Exchange.

2. *The Course of Exchange* is the value agreed upon by merchants, or their factors; and is continually fluctuating above or below the *Par of Exchange*, as the demand for bills is greater or less.

3. *The Par of Exchange* is that quantity of the money of one country which is intrinsically equal to a certain quantity of the money of another, whether real or imaginary.

4. *The real Money* of every Empire, Kingdom, State, &c. signifies one piece, or more, of any kind of metal, coined by the authority of that Empire, Kingdom, State, &c. and current at a certain value by virtue of such authority.

5. *The imaginary Money* is used in keeping accounts, and includes all the denominations which are used to express any sum of money, of which no such species are current in any Empire, Kingdom, State, &c.

6. *The Agio* denotes the difference in foreign countries between the current or cash-money, and the exchange or bank-money, the latter being compounded of a finer, or purer, metal than the former.

Note. When current, or cash-money is taken in payment, the merchants have an allowance of so much per cent. according to what exchange-money is worth more than the current-money.

7. *Bank-Notes*, in the business of exchange, are such as are obtained from foreign bankers for money lodged in their bank.—These are called bank-money.

8. *Usance* is a certain space of time allowed, by one country to another, for the payment of bills of exchange. It varies according to the custom of countries, and frequently in proportion to the distance of places from each other.—Bills are either payable at sight, or so many days after sight; at usance, double usance, or half usance.

9 *The Days of Grace* are a certain number of days allowed for the payment of Bills of Exchange, after the expiration of the term specified in such bills, and are variable in different countries. In some countries no days of grace are allowed.

EX-

EXCHANGE WITH HOLLAND AND THE NETHERLANDS.

Claſs 1. Places which given an uncertain or variable price of exchange for the pound ſterling, viz. Amſterdam, Rotterdam, Zealand, Holland, and the reſt of the United Provinces; Antwerp, Brabant, Flanders, and the Auſtrian Netherlands; Hamburgh, &c.

Rules for converting ſterling money into the money of any of the above cities or countries, and the contrary.

PROPOSITION I.

Given the Courſe of Exchange between Great-Britain and any foreign Country, City, &c. which exchanges for the Pound Sterling, to change any given Quantity of Sterling Money into the Money of that Country, &c.

Rule. As 1l. ſterling is to the given courſe of exchange, ſo is the given ſum, in ſterling money, to its correſponding value in foreign money.

Note. Whenever the firſt term of a ſtating is 1, as in this propoſition, the work may be performed by Practice.

PROPOSITION II.

Given the Courſe of Exchange to or from any foreign Country, City, &c. which Exchanges with Great-Britain for the Pound Sterling, to change any given Quantity of ſuch foreign Money into ſterling Money.

Rule. As the courſe of Exchange is to 1l. ſterling, ſo is the given ſum, in foreign money, to its correſponding value in ſterling money.

Table I. THE SEVEN UNITED PROVINCES, &c.

At Amſterdam, Rotterdam, Leyden, Middleburgh, Fluſhing, &c. and at Antwerp, Bruſſels, &c. in the Auſtrian Netherlands, the loweſt piece of money is a pening; and all accounts are kept in guilders, ſtivers, and penings, or in Flemiſh pounds, ſhillings, and pence. The par of exchange between

between London and Amſterdam is 100 guilders for 9l. ſterling, but the courſe of exchange varies from 30 to 38 ſhillings Flemiſh per £ ſterling.

8 Penings	make	1	Grot, or penny.
2 Grots	—	1	Stiver.
6 Stivers	—	1	Shilling.
20 Stivers	—	1	Florin, or guilder.
2½ Guilders	—	1	Rix-dollar.
6 Guilders	—	1	Pound.

This is one of the moſt uſeful Tables in Exchange, the Bank of Amſterdam being the moſt conſiderable in Europe; and as the buſineſs there is negociated by transfers, millions may be paid in a day, without the intervention of caſh. On account of its great utility, I ſhall give it in another form for the learner's encouragement.

8 Penings	= 1 Grot.				
16	= 2	= 1 Stiver.			
96	= 12	= 6	= 1 Shilling.		
320	= 40	= 20	= 3⅓	= 1 Guilder.	
800	= 100	= 50	= 8⅓	= 2½	= 1 Rix-dollar.
1920	= 240	= 120	= 20	= 6	= 2⅔ = 1 Pound Flemiſh.

PROPOSITION.

To reduce, the Currency of any State into Bank or Exchange Money, and the contrary.

Rule. As 100, with the agio added to it, is to 100, ſo is any given ſum current to its value in Bank-money.

And, as 100 is to 100 with the agio added to it, ſo is any given ſum of Bank-money to its value current.

Note. The exchange is always ſuppoſed to be made in Bank-money, and therefore the currency of any State, or Kingdom, which uſes this denomination of money, muſt always be reduced to Bank-money before exchange can be made.

(1.) A merchant at Amſterdam is poſſeſſed of 3750 guilders, 10 ſtivers currency, which he wiſhes to turn into Bank-money, the agio at 4⅜ per cent.; what will be the value in guilders bank?

As 104⅜ : 100 :: 3750g. 10s. : 3593g. 5s. 13 1/167 pen. anſ.

(2.) If the agio between the current and Bank-money of the United Provinces, be 4⅜ per cent. how many guilders current will be equal to 3593 guilders, 5 ſtivers, 13 1/167 pen. Bank?

As 100 : 104⅜ :: 3593guil. 5s. 13 1/167 pen. :: 3750g. 10s. anſ.

(3.) Change

(3.) Change 577 guilders, 14 ſtivers current money, into Bank florins, agio $5\frac{4}{5}$ per cent?—Anſ. 546g. $9\frac{3}{5}\frac{6}{10}$pen.

(4.) Change 765 guilders, 9 ſtivers Bank, into current, agio $5\frac{5}{8}$ per cent?—Anſ. 808g. 10ſt. $2\frac{1}{10}$pen.

(5.) In 7570 guilders, 15 ſtivers current, how many rix-dollars Bank, agio $4\frac{7}{8}$ per cent.?—Anſ. 2887rix-d. $26\frac{3}{8}\frac{6}{10}$ſt.

(6.) If the agio between the current and Bank money of the Netherlands be 25 per cent. how many pounds, Flemiſh Bank, will be equal to 797l. Flemiſh?—Anſ. 637l. 12s.

*(7.) What is the value of 2185 guilders, 18 ſtivers, of the currency of Rotterdam, in Bank money, when the agio is $5\frac{1}{2}$ guilders per cent?—Anſ. 2071g. 18s. $\frac{1}{2}\frac{8}{10}\frac{2}{0}$ Bank.

See the Rules to Propoſition I and II page 103.

(8.) xiii. If I pay 757l. 18s. 7d. in London, what muſt I draw my bill for on Amſterdam, exchange at 11. 15s. 9d. Flemiſh per £ ſterling?—Anſ. 1354l. 15s. $11\frac{1}{2}$d. $\frac{9}{20}$.

(9.) xiv. If I pay in London 754l. 11s. 9d. ſterling, how many guilders, &c. may I draw for at Amſterdam, exchange at 34 ſhillings $4\frac{1}{4}$ grots per £ ſterling?—Anſ. 7781g. 13ſt. $10\frac{3}{4}$pen.

(10.) xv. In 479l. 14s. ſterling, how many rix-dollars current, agio $4\frac{5}{8}$, and exchange at 34s. $7\frac{1}{2}$d. per £ ſterling?—Anſ. 2085rix-d. 16ſt. $13\frac{9}{10}\frac{5}{0}\frac{9}{0}$pen.

(11.) xxiii. Remitted from Amſterdam to London a bill of 1747l. 14s. 7d. Flemiſh, how many pounds ſterling is the ſum, exchange at 34s. 7d. Flemiſh per £ ſterling?—Anſ. 1010l. 14s. $8\frac{1}{4}$d. $\frac{45}{83}$.

(12.) xxiv. What muſt I draw for at London, if I pay at Rotterdam 7495guild. 14ſt. current, agio $5\frac{3}{8}$ per cent. exchange at 34 ſhillings 4 grots per £ ſterling?—Anſ. 690l. 12s. 4d.

(13.) xxv. A merchant remits a Bill of Exchange, from Antwerp to England, when the courſe is 34s. 3d. required the value of 774l. 18s. Flemiſh, at that rate in London?—Anſ. 452l. 9s. $11\frac{17}{137}$d.

EXCHANGE WITH GERMANY.

TABLE II. GERMANY.

At Hamburgh, Altena, Lubec, Bremen, &c. the loweſt piece of money is a tryling; and all accounts are kept in marks, ſhillings lub, and deniers, or in pounds, ſhillings, and

and pence Flemiſh. The par of exchange between Hamburgh and London is 40 marks lub for 3l. ſterling; but the courſe of exchange varies from 28 to 38 ſhillings Flemiſh per £ ſterling.

4 Trylings	make	1	Fening.
12 Fenings, or 2 Deniers	—	1	Shilling Lub.
6 Sols, or Shillings Lub	—	1	Sol, or Shilling Gros.
16 Shil. Lub	—	1	Mark.
2 Marks	—	1	Slet Dollar.
3 Marks, or 48 Shil. Lub	—	1	Rix-dollar.
7½ Marks, or 120 Shil. Lub	—	1	Pound Flemiſh.

Theſe places change either by the Rix-dollar, Slet Dollar, or Mark.

Note. Lub, or Lubs, is a term derived from the City of Lubec, where the ſhillings, or ſols lub are coined.

See the Rules to Propoſition I and II page 103.

(14.) viii. In 1271. 3s. 4d. ſterling, how many Hamburgh marks, &c. exchange at 32⅓ ſols gros, or 2328fen. per £ ſterling?—Anſ. 1541m. 14ſhil. lub, 4fen.

(15.) ix. How many Hamburgh marks are contained in 4751l. 15s. ſterling, exchange at 2450 fenings per £ ſterling? —Anſ. 60634m. 4ſol lub, 11½fen.

(16.) x. In 475l. 18s. ſterling, how many marks, &c. exchange at 36s. 6d. Flemiſh per £ ſterling?—Anſ. 6513m. 14$\frac{1}{10}$ſols lub.

(17.) xi. In 794l. 14s. ſterling, how many marks Bank money, exchange at 35 ſols groſs, 1 denier per £ ſterling, 6 fenings being equal to 1 denier, and 12 deniers to 1 ſol gros? —Anſ. 9863m. 3ſols lub, 10⅕fen.

(18.) xii. In 754l. 18s. 9d. ſterling, how many rix-dollars current, exchange at 34 ſols gros, 9¼ den. per £ ſterling, agio 108¼?—Anſ. 3551 rix-d. 44ſols lub, 5$\frac{1}{2}\frac{1}{8}\frac{2}{0}\frac{4}{6}\frac{8}{0}$ fen.

(19.) xviii. Reduce 1541 marks, 14 ſols lub, 4 fen. Bank money of Hamburgh into ſterling, exchange at 32⅓ ſols gros per £ ſterling, 72 fenings being equal to 1 ſol gros.—Anſ. 127l. 3s. 4d.

(20.) xix. In 1788 Rix-dollars, 21 ſols lub, how many pounds ſterling, exchange at 34½ ſols gros per £ ſterling?— Anſ. 414l. 14s. 2¼d. $\frac{17}{21}$.

(21.) xx. In 747 rix-dollars, 2 marks, 14 ſols lub, how £ ſterling, exchange at 32s. 6d. per £ ſterling?—Anſ. 184l. 2s. 3$\frac{1}{13}$d.

(22.) xxi. In 743 rix-dollars, 4 ſols gros, ſlet money, agio 4⅜ per cent. exchange at 33s. 9d. how many pound ſterling? —Anſ. 168l. 8s. 11$\frac{5}{11}$d.

(23) xxii.

(23.) xxii. In 1749 marks, 13 ſols lub, agio $9\frac{3}{8}$ per cent. and 474 ſlet dol. 2 ſols gros, agio $4\frac{3}{8}$ per cent. exchange at 35s. 8d. Flemiſh per £ ſterling, how many £ ſterling?—Anſ. 187l. 11s. $5\frac{1}{4}$d.

EXCHANGE WITH SWEDEN.

TABLE III. SWEDEN.

At Stockholm, Upſal, Tornea, &c. the loweſt piece of money is a runſtic; and all accounts are kept in rix-dollars, ſilver dollars, copper dollars, and runſtics. The par of exchange (when they exchange immediately with London) is 1l. ſterling for 20 copper dollars; but the courſe of exchange is ſubject to great variation.—Bills drawn upon Sweden have an allowance of 12 days grace.

8 Runſtics	make	1 Copper Mark.
4 Copper Marks	—	1 Copper Dollar.
3 Copper Dollars	—	1 Silver Dollar.
3 Silver Dollars	—	1 Rix-dollar.
2 Rix-dollars	—	1 Ducat.

Note. The chief medium of commerce in Sweden is copper, which is exceedingly inconvenient, ſome of the pieces being nearly as large as tiles; theſe and ſmall bank-notes are almoſt their only circulating money.

See the Rules to Propoſition I and II page 103.

(24.) xvi. In 547l. 19s. 10d. ſterling, how many copper dollars of Stockholm, exchange at $47\frac{1}{2}$ copper dollars per £ ſterling?—Anſ. 26029cop. dol. 2cop. marks, $3\frac{1}{3}$run.

(25.) xvii. In 3749l. 14s. $10\frac{1}{2}$d. how many marks, &c. exchange at 48 copper dollars per £ ſterling?—Anſ. 179987 cop. dol. 2cop. mks. $6\frac{2}{3}$run.

(26.) In 7123 copper dollars, 14 runſtics, how many pounds ſterling, exchange at $48\frac{1}{2}$ copper dollars per £ ſterling?—Anſ. 146l. 17s. 6d.

(27.) In 5749 ſilver dollars, 1 copper dollar, 2 copper marks, 3 runſtics, how many pound ſterling, exchange at 49 copper dollars per £ ſterling?—Anſ. 352l. os. $2\frac{3}{4}$d. $\frac{3}{49}$.

Claſs II. Places which give the certain ſpecies of their money, for the uncertain number of pence ſterling, viz. Denmark, Ruſſia, Poland, France, Spain, Portugal, Italy, &c. &c.

Rules for changing ſterling money into the money of any of the above Countries, and the contrary.

PRO-

PROPOSITION I.

Given the Courſe of Exchange between Great-Britain and any foreign Country, City, &c. which exchanges for any Number of Pence ſterling, to change any Quantity of ſterling Money into the Money of that Country, &c.

Rule. As the number of pence ſterling, contained in the courſe of exchange, is to the integer of foreign money, ſo is the given ſum, in ſterling money, to its correſponding value in foreign money.

PROPOSITION II.

Given the Courſe of Exchange between Great-Britain and any foreign Country, City, &c. which exchanges for any Number of Pence ſterling, to change any Quantity of ſuch foreign Money into ſterling.

Rule. As the integer of foreign money is to the number of pence contained in the courſe of exchange, ſo is the given quantity of foreign money to its correſponding value in ſterling money.

EXCHANGE WITH DENMARK.

TABLE IV. DENMARK.

At Copenhagen, Elſinore, Bergen, Drontheim, &c. the loweſt piece of money is a ſkilling; and all accounts are kept in rix-dollars, marks, and ſkillings. The par of exchange between London and Denmark is 4s. 6d. ſterling for the rix-dollar, but the courſe of exchange varies from 45d. to 58d. ſterling for the rix-dollar.

16 Skillings, or ſhillings make 1 Mark.
6 Marks —— 1 Rix-dollar.

See the Rule to Propoſition I and II page 108.

(28.) In 747l. 18s. 10d. ſterling, how many rix-dollars of Denmark, exchange at 47d. ſterling per rix-dollar?—Anſ. 3819rix-dol. 1mk. $10\frac{2}{47}$ſk.

(29.) In

(29.) In 7491. 16s. ſterling, how many rix-dollars, &c. exchange at 49½d. ſterling per rix-dollar?—Anſ. 3635rix-d. 2mks. 5$\frac{9}{11}$ſk.

(30.) xxxii. In 3819 rix-dollars, 1 mark, 10$\frac{26}{47}$ ſkillings of Denmark, how much ſterling money, exchange at 47d. ſterling per rix-dollar?—Anſ. 747l. 18s. 10d.

(31.) xxxiii. In 9751 rix-dol, 4 mks. 3ſkil. how much ſterling, exchange at 48¾d. ſterling per rix-dollar?—Anſ. 1980l. 16s. 3¼d. $\frac{3}{32}$.

EXCHANGE WITH RUSSIA.

TABLE V. RUSSIA.

At Peterſburgh, Archangel, Riga, &c. They keep their accounts in rubles and copecs; and exchange with London by way of Amſterdam or Hamburgh, at the rate of 48 or 50 ſtivers per ruble; ſometimes they exchange directly with London, from 4 to 5s. per ruble.

3	Copecs	make 1	Altin.
10	Copecs	— 1	Grivener.
25	Copecs	— 1	Polpotin.
2	Polpotins	— 1	Poltin.
2	Poltins	— 1	Ruble.
2	Rubles	— 1	Xervonitz, or ducat.

See the Rules to Propoſition I and II. page 108.

(32.) xxx. In 7574l. 19s. ſterling, how many Ruſſian rubles, &c. exchange at 4s. 7d. ſterling per ruble?—Anſ. 33054 rub. 32cop. 2$\frac{2}{11}$alt.

(33.) xxxi. In 574l. 18s. ſterling, how many rubles, &c. exchange at 4s. 9½d. per ruble?—Anſ. 2399rub. 58$\frac{6}{13}$ cop.

(34.) In 7454 rub. 4 griv. 6 cop. how many pounds ſterling, exchange at 4s. 9d. per ruble?—Anſ. 1770l. 8s. $\frac{11}{16}$d.

(35.) In 7479 rubles, how much ſterling, exchange at 4s. 7½d. per ruble?—Anſ. 1729l. 10s. 4½d.

The following examples require an application of the rules, &c. belonging to Amſterdam.

(36.) In 4759 rub. 44 cop. exchange at 124 copecs per rix-dollar, current at Amſterdam, agio 3½ per cent. how much ſterling money, the exchange between Amſterdam and London being 34s. 6d. Flemiſh per £ ſterling?—Anſ. 895l. 15s. 3¼d. ſterling.

(37.) Remitted from London to Peterſburgh, by the way of Amſterdam, 495l. 17s. 6d. ſterling, the exchange between

London and Amſterdam being 34s. 8d. per £ ſterling, and between Amſterdam and Peterſburgh 52 ſtivers per ruble; what is the value of this remittance in rubles, &c.?—Anſ. 7934rub.

(38.) Received from Archangel, per Bill of Exchange, 7437 rubles, 5 griv. 24 cop. exchange at 121 copecs per rix-dollar, current of Amſterdam, agio $3\frac{1}{8}$ per cent. and 24s. 7d. Flemiſh per £ ſterling, what is the value of this bill?—Anſ. 1436l. 5s. $10\frac{3}{4}$d.

EXCHANGE WITH POLAND AND PRUSSIA.

TABLE VI. POLAND AND PRUSSIA.

At Cracow, Warſaw, and Dantzic, Koningſberg, Elbin, Thorn, &c. the loweſt piece of money made uſe of is a ſhelon, and their accounts are kept in groſhens, couſtics, and florins; they exchange with London (by the groſh) by the way of Amſterdam.

3	Shelons	make	1 Groſh.
5	Groſhen	—	1 Couſtic.
30	Groſhen	—	1 Florin.
270	Groſhen	—	1 Pound Flemiſh.
110	Groſhen	—	1 Rix-dollar, Bank of Hamburg.

The following examples require an application of the Rules belonging to Amſterdam, as well as thoſe to Propoſition I. and II. page 108.

(39.) In 7947 florins of Dantzic, exchange at 270 groſhen per £ Flemiſh, and 33s. 5d. Flemiſh per £ ſterling, how much ſterling?—Anſ. 528l. 9s. $6\frac{3}{4}$d. $\frac{261}{400}$.

(40.) In 749l. 17s. 6d. ſterling, how many rix-dollars, &c. exchange at 274 groſhen per £ Flemiſh, and 34s. 8d. per £ ſterling?—Anſ. 3957rix-dol. $10\frac{120}{300}$groſhen.

(41.) In 4795 flor. 4 couſtics, 4 groſhen, how many pounds ſterling, exchange at 273 groſhen per £ Flemiſh current, agio $3\frac{3}{8}$ per hundred guilders, and 33s. 7d. Flemiſh per £ ſterling?—Anſ. 303l. 12s. $1\frac{1}{4}$d. ſterling.

EX-

EXCHANGE WITH FRANCE.

TABLE VII. FRANCE.

At Paris, Rouen, Bourdeaux, Bayonne, Marſeilles, Lyons, Dunkirk, St. Omers, Boulogne, &c. the loweſt piece of money in uſe is a denier, and all accounts are kept in livres, ſols, and deniers.

12 Deniers	make	1 Sol, or Sou.
20 Sols	—	1 Livre Tournois.
3 Livres	—	1 Crown, or Ecu of Exchange.
24 Livres	—	1 Louis d'or.

Note. Tournois is a term of the ſame import in France, as ſterling in England.

See the Rules to Propoſition I. and II. page 108.

(42.) In 636 livres tournois, 3 ſols, $9\frac{1}{2}$ deniers, how many £ ſterling, exchange at $31\frac{1}{2}$d. per ecu of 3 livres?—Anſ. 27l. 16s. $7\frac{3}{4}$d. $\frac{77}{80}$.

(43.) Bought wine of a merchant at Bourdeaux to the amount of 57475 livres, 6 ſols; for what ſterling money muſt the merchant draw his bill, exchange at 53d. per ecu?—Anſ. 4230l. 16s. $4\frac{1}{2}$d. $\frac{8}{23}$.

(44.) A bill of 759l. 18s. 9d. is remitted to Paris by a merchant in London; what is the value in French crowns, exchange at 54d. per ecu?—Anſ. $3377\frac{1}{2}$ crowns.

(45.) A gentleman (on his travels) received at Paris 3749 crowns, 2 livres, 10 ſols, for a Bill of Exchange, the value whereof in England was 843l. 14s. 3d. what was the courſe of exchange between England and France?—Anſ. 54d. per ecu.

EXCHANGE WITH SPAIN.

TABLE VIII. SPAIN.

The denominations of money are various in different parts of Spain; at Madrid, Cadiz, Seville, &c. they reckon by the new plate, of which

34 Maravedies	make	1 Rial.
8 Rials	—	1 Piaſtre, or Piece of Eight.
10 Rials	—	1 Dollar.

At Gibraltar, Malaga, &c. they reckon by the money of Veillon, of which

4 Maravedies	make	1 Quartil.
34 Maravedies	—	1 Rial Veillon.
15 Rials	—	1 Piaſtre, or Piece of Eight.

At Barcelona, Valencia, Carthagena, &c. they reckon by the old plate, of which

32 Maravedies, or 2 ſoldos	make	1 Rial.
16 ſoldos	———	1 Dollar.

Note. Two rials veillon make but 1 rial of plate, and 16 rials veillon 1 piaſtre; only ſome parts of Spain exchange immediately with London.—The par of exchange between London and Madrid, &c. is, that 1900 rials are worth 51l. ſterling.

See the Rules to Propoſition I. and II. page 108.

(46.) In 749l. 18s. ſterling, how many piaſtres, or pieces of eight, at Madrid, exchange at $45\frac{3}{8}$ ſterling per piaſtre?—Anſ. $3966\frac{510}{1711}$ piaſtres.

(47.) In 1347 piaſtres, 2 rials, 24 maravedies of Madrid, how much ſterling, exchange at $47\frac{1}{2}$d. per piaſtre?—Anſ. 266l. 13s. $2\frac{1}{2}$d. $\frac{9}{34}$.

(48.) In 9749 rials of plate, how many pound ſterling, exchange at $43\frac{1}{8}$d. per piaſtre?—Anſ. 218l. 19s. $5\frac{3}{4}\frac{3}{4}$d.

(49.) Bought raiſins of a merchant at Malaga to the amount of 7549 rials veillon; for what ſterling money muſt the merchant draw his bill, exchange at $41\frac{1}{2}$d. per piaſtre?—Anſ. 87l. 0s. $5\frac{1}{2}$d. $\frac{2}{3}$.

EXCHANGE WITH PORTUGAL.

TABLE IX. PORTUGAL.

At Liſbon, Oporto, &c. the loweſt piece of money is a Re, and all accounts are kept in rez and milrez. The par of exchange between London and Portugal is 5s. $7\frac{1}{2}$d. ſterling for the milre.

20 Rez	make	1 Vintin.
100 Rez	—	1 Teſtoon.
400 Rez	—	1 Cruſade.
1000 Rez	—	1 Milre.

The Portugueze ſeperate the rez from the milrez, by a mark reſembling the Greek theta.

See the Rules to Propoſition I. and II. page 108.

(50.) In 7434

(50.) In 7434 cruſades, 347 rez, how many £ ſterling. exchange at 65d. per milre?—Anſ. 805l. 8s. $10\frac{1}{2}$d. $\frac{11}{50}$.

(51.) A merchant at Liſbon remits to London 4756 milrez, 2 teſtoons, 4 vintins, 10 rez, exchange at $64\frac{1}{2}$d, per milre, how much ſterling muſt be paid for this remittance?—Anſ. 1278l. 5s. $0\frac{1}{2}$d. $\frac{4}{50}$.

(52.) If a bill of 1788l. 17s. ſterling, be drawn upon London, what is the value at Oporto, in milrez, exchange at $66\frac{1}{2}$d. per milre?—Anſ. 6456 milrez.

(53.) If 2000 milrez were paid at Liſbon for a bill upon London of 666l. 13s. 4d. what is the courſe of exchange?—Anſ. 6s. 8d. per milre.

EXCHANGE WITH ITALY.

TABLE X. ITALY.

At St. George's Bank, in the Republic of Genoa, the loweſt piece of money is a denari, and all accounts are kept in piaſtres or pezzos, divided into ſolidi and denari, as the pound ſterling; others keep their accounts in lires, ſolidi, and denari.

12	Denari, or Deniers	make	1 Solidi, or Sol.
20	Solidi	—	1 Lire, or Livre.
5	Lires	—	1 Croiſade, Crown, Piaſtre, or Dollar.
115	Solidi, or $5\frac{3}{4}$ Lires	—	1 Piaſtre, or Pezzo of Exchange.

At Florence, Leghorn, &c. in Tuſcany,

12	Denari, or Deniers	make	1 Solidi, or Sol.
20	Solidi	—	1 Lire, or Livre.
6	Lires, or Livres	—	1 Piaſtre, or Piece of Eight
$7\frac{1}{2}$	Lires	—	1 Ducat, Ducatoon, or Ecu.

At Venice, &c. in the Republic of Venice, the denominations of money are theſe:—

12	Denari, or Deniers	make	1 Solidi, or Sol.
6	Solidi	—	1 Groſs.
24	Groſſes	—	1 Ducat of Exchange.

The current, or picoli money is 20 per cent. worſe than the Bank money.—This 20 per cent. is an eſtabliſhed agio.

See the Rules to Propoſition I and II. page 108.

(54.) How much ſterling money may a perſon receive in London, if he pay in Genoa 947 dollars, exchange at 53½d. per dollar?—Anſ. 211l. 2s. 0½d.

*(56.) Venice is indebted to London 4789 ducats, 19s. 3d. picoli, or current, money; how much ſterling may London draw for, agio 20 per cent. when the exchange is at 4s. 1d. per ducat banco?—Anſ. 814l. 19s. 2⅛d.

(56.) In 747l. 16s. 4d. ſterling, how many pezzos of Leghorn, exchange at 46⅜d. per pezzo?—Anſ. 3870pez. $2\frac{18}{371}$ſol.

(57.) London is indebted to Leghorn 7439 pezzos, or piaſtres, 9 ſolidi, 3 denari; what ſterling money ſtands as an equivalent in the London merchant's books, the exchange being at 48¾d. per piaſtre?—Anſ. 1499l. 10s. 3¾d. $\frac{150}{160}$.

(58.) A bill of 574l. 15s. is remitted to Florence, to be paid in piaſtres of 6 lires each, exchange at 54d. per piaſtre; how many will be received?—Anſ. 2554pia. 2lires, 13ſol. 4den.

Claſs III. Places which exchange with Great Britain at an advanced rate per cent. Theſe are the Iſles of Man and Ireland, the Weſt-India Iſlands, and the Continent of America.

Rules for changing ſterling-money into the money of any of the above countries, and the contrary.

PROPOSITION I.

Given the Courſe of Exchange between Great-Britain and any Place which gives a variable Sum of Money, more than 100l. *for* 100l. *ſterling, to change any Quantity of ſterling-money into the Currency of that Place.*

Rule. As 100l. ſterling is to 100l. with the courſe of exchange per cent. added to it, ſo is the given ſterling money to the current required.

Note. In this and the following rule, by the courſe of exchange, muſt be underſtood the exceſs of the currency above 100l. Thus, if 100l. ſterling be worth 110l. currency, the exchange is at 10 per cent.

This exceſs, were it authoriſed by cuſtom, might be called the agio.

PRO-

PROPOSITION II.

Given the Courſe of Exchange between Great Britain and any Place which gives a variable Sum of Money, more than 100*l. for* 100*l. ſterling, to change any Quantity of the Currency of that Place into ſterling Money.*

Rule. As 100l. with the courſe of exchange per cent. added to it, is to 100l. ſo is the given currency to the ſterling required.

EXCHANGE WITH IRELAND.

TABLE XI. IRELAND.

At Dublin, Cork, Londonderry, &c. accounts are kept in pounds, ſhillings and pence as in England. The Iriſh have no coin of their own, but are ſupplied by the different nations with which they traffic. The par or rate of exchange between England and Ireland is 108l. 6s. 8d. currency of the latter for 100l. ſterling; ſo that for an Engliſh ſhilling, a perſon in Ireland will receive 13 Engliſh pence, and for a guinea 22 Engliſh ſhillings and nine-pence.

See the Rules to Propoſition I. and II. pages 114 and 115.

(59.) London remits to Ireland 574l. 15s. ſterling, how much currency of Ireland muſt be received, exchange at 7l. 10s. per cent?—Anſ. 617l. 17s. $1\frac{1}{2}$d.

(60.) The value of 694l. 18s. 6d. ſterling is required in Iriſh currency, exchange at $5\frac{3}{4}$l. per cent.?—Anſ. 734l. 17s. $7\frac{3}{4}$d. $\frac{43}{80}$.

(61.) lxii. Dublin draws upon London for 879l. 6s. $6\frac{1}{4}$d. Iriſh, exchange at $11\frac{3}{4}$l. per cent. how muſt London pay Dublin to diſcharge the bill?—Anſ. 787l. $15\frac{5}{47}\frac{5}{69}$ſh.

(62.) lxiii. What muſt be paid in London for a remittance of 6747l. 14s. Iriſh, exchange at $11\frac{1}{2}$d. per cent.?—Anſ. 6051l. 14s. $11\frac{1}{2}$d. $\frac{206}{213}$.

EXCHANGE WITH AMERICA AND THE WEST-INDIES.

TABLE XII. AMERICA AND THE WEST-INDIES.

In the Province of Nova Scotia, New Brunſwick, Canada, the United States of America, and the Weſt India Iſlands, accounts are kept in pounds, ſhillings, and pence, as in England, and their money is called currency. The ſcarcity of caſh in America, obliges them to ſubſtitute a paper-currency, and the courſe of exchange varies in proportion to the ſcarcity of money, from 170l. to 800l. or upwards, for 100l. ſterling.—In the Weſt India Iſlands the courſe of exchange is not ſo variable; and ſometimes from the plenty of foreign coins amongſt them, does not exceed 25l. per cent. and is ſeldom more than 50l. per cent. though it has ſometimes riſen as high as 70l. per cent.

See the Rules to Propoſition I. and II. pages 114 and 115.

(63.) lxi. London receives a bill of exchange from Carolina for 917l. 18s. ſterling; for how much currency was London indebted, exchange at 76l. per cent. ?—Anſ. 1615l. 10s. $0\frac{3}{4}$d. $\frac{21}{25}$.

(64.) Jamaica remits to London 475l. 14s. 10d. currency; what ſterling-money muſt be received for it, exchange being at 135l. currency for 100l. ſterling ?—Anſ. 352l. $8\frac{2}{81}$ſh.

(65.) A merchant in London conſigns to his factor, in Jamaica, goods amounting to 734l. 14s. 9d. ſterling, which are ſold for 900l. currency; what ſterling ought the factor to remit, after deducting 5 per cent for his commiſſion and charges; and whether does the merchant gain or loſe, and how much; the exchange being at 25l. per cent. ?—Anſ. 50l. 14s. 9d. loſs.

(66.) My factor at Barbadoes bought goods for me to the amount of 7150l. 14s. currency; what is the value in ſterling money, allowing the factor $2\frac{1}{2}$d. per cent. for commiſſion, the exchange being at 35l. per cent. ?—Anſ. 5164l. 7s. $10\frac{1}{2}$d. $\frac{2}{3}$.

(67.) A

(67.) A merchant at Boſton ſtands indebted to his correſpondent in London 7549l. 18s. 4d. currency; what ſterling ſum ſtands as an equivalent in the London merchant's books, exchange at 57 per cent.?—Anſ. 4808l. 17s. $3\frac{1}{4}$d. $\frac{87}{137}$.

(68.) Sold ſugars in London for my employer in Jamaica to the amount of 1757l. ſterling; what currency ought I to remit, after deducting $2\frac{1}{2}$ per cent. for commiſſion; the exchange between London and Jamaica being 157l. currency for 100l. ſterling?—Anſ. 2689l. 10s. $6\frac{1}{2}$d. $\frac{16}{25}$.

THE

THE

New Schoolmaster's Assistant,

OR

SCHOLAR's EASY GUIDE

TO

ARITHMETIC.

PART III.

(§. 1.) ALLIGATION.

DEFINITION. When different sorts of wine, corn, spices, metals, &c. or any number of simples, of different qualities, are required to be mixed together, the method of proportioning such a mixture is called Alligation, from the quantities being generally linked, or joined, together by curved or streight lines.

PROPOSITION I.

Given the particular Quantities mixed, and their respective Rates, or Prices, to find the mean Rate, or Price, of the Compound, this is called Alligation medial.

Rule. Multiply the quantities of the mixture by the respective rates, or prices, reduced to one denomination, and divide

divide the ſum of the products by the ſum of the quantities, the quotient will be the mean rate, or price.

The Method of Proof. Find the whole value of the mixture at the mean price, and if it is the ſame with the total value of the ſeveral ingredients, at their reſpective prices, the work is right.

(1.) A vintner would mix 2 gallons of wine, at 14s. per gallon, with 1 gallon at 12s. two gallons at 9s. and four gallons at 8s. per gallon. What will be the worth of a gallon of this mixture?

2	gallons multiplied by	14s.	gives	28 product.
1	——— by	12s.	——	12
2	——— by	9s	——	18
4	——— by	8s.	——	32
9	Sum of the products		90	this, divided by 9, (the ſum of the quantities) gives 10s. the value, or mean rate, of a gallon, anſwer.

(2.) A grocer would mix 4 cwt of ſugar at 2l. 18s. per cwt, 7cwt 2qr at 2l. 13s. per cwt, 5cwt 1qr at 1l. 19s. per cwt, and 3cwt 3qr at 1l. 14s. per cwt together; what is the worth of a cwt of this mixture?—Anſ. 2l. 6s. $10\frac{3}{4}$d. $\frac{37}{41}$.

(3.) A tobacconiſt mixed 50lb of tobacco, at $11\frac{1}{2}$d. per lb with 40lb at 14d. per lb, 27lb at 2s. 6d. per lb, and 87lb at 3s. per lb. What was the worth of 1lb of this mixture?—Anſ. 2s. $0\frac{3}{4}$d. $\frac{28}{31}$.

(4.) A farmer mixed 2qr 4buſh of corn, worth 2l. per qr. 4qr 4buſh of an inferior kind, worth 1l. 4s. per quarter; and 5qrs of a third kind, worth only 16s. per quarter: required the value of a quarter of this mixture?—Anſ. 1l. 4s.

PROPOSITION II.

Given the Rates, or Prices, of ſeveral Ingredients to find the Quantities thereof, ſo that the Mixture may be ſold at a given Rate, or Price, this is called Alligation alternate.

Rule 1. Reduce the particular rates to the ſame denomination as the mean rate; write them orderly under each other, beginning with the greateſt, and place the mean rate to the left hand of them.—Then connect the ſimple rates together, ſo that each rate leſs than the mean may be coupled with one greater, or with each greater; and each rate greater than the mean with one leſs, or with each leſs.

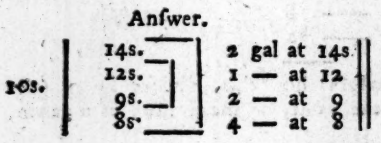
2. Take

2. Take the difference between each ſimple rate and the mean rate, and place it alternately; that is, againſt the rate with which it is linked.—Then, if only one difference ſtand againſt any rate, it will be the quantity belonging to that rate; but, if there be ſeveral, their ſum will be the quantity.

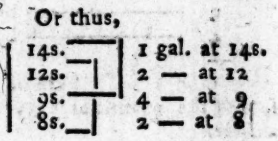
Queſtions under this and the following Rules may be proved by the Rule of Alligation medial.

(5.) A vintner would mix four ſorts of wine, of different prices, together, viz. at 14s. 12s. 9s. and 8s. per gallon; what quantity of each ſort muſt he put into the compound, that he may be enabled to ſell it at 10s. per gallon?

Anſwer.

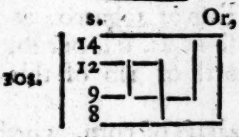


Or thus,



Otherwiſe.

Or,



(6.) A grocer wiſhes to mix ſugar at 4d. 6d. and 10d. per lb ſo that he may ſell the mixture at 8d. per lb. What quantity of each may he take?—Anſ. 6lb at 10d.—2lb at 6d.—2lb at 4d.

(7.) A goldſmith would mix gold of 23 carats fine, with gold of 20 carats, ſome of 18, ſome of 17, and ſome of 14, carats fine; how much of each ſort muſt he melt together to form a compoſition of 19 carats fine?—Anſ. 5 of 23 carats, 3 of 20, 1 of 18, 1 of 17, and 4 of 14 carats fine.

(8.) A provider for the army, deſirous of mixing wheat at 4s. per buſhel, with rye at 3s. per buſhel, barley at 2s. per buſhel, peaſe at 1s. 4d. per buſhel, and oats at 1s. per buſhel, wiſhes to be informed how to proportion the mixture, that it may be worth 1s. 8d. per buſhel?—Anſ. 8 buſhels of wheat, 4 of rye, 4 of barley, 20 of peaſe, and 28 of oats.

Note. By reducing the ſeveral rates into pence, upwards of 22 anſwers, in whole numbers, may be obtained to this queſtion by the different methods of linking the ſimples only.

PRO-

Proposition III.

Given the Rates or Prices of several Ingredients, the Quantity of one, and the mean Rate, to find the several Quantities of the Rest in Proportion to that given; this is called Alligation Partial.

Rule. Take the difference between each rate and the mean, as before.—Then, as the difference ſtanding againſt the price of the given quantity is to that quantity, ſo are the ſeveral other differences to their reſpective quantities.

(9.) A merchant propoſes to mix four ſorts of wine together, viz. 2 gallons of one ſort, at 14s. per gallon, with others at 12s. 0s. and 8s. per gallon; how many gallons of each ſort muſt he take to make a compoſition worth 10s. per gallon?

2 diff. : 2 gal. :: 3 diff. : 3 gal.
2 diff. : 2 gal. :: 2 diff. : 2 gal.
2 diff. : 2 gal. :: 6 diff. : 6 gal.
} Anſwer.

Note. Different anſwers may be obtained by linking the quantities differently.

(10.) A diſtiller would mix 80 gallons of brandy, at 12s. per gallon, with another ſort at 7s. and a third at 4s. per gallon; what quantity of each ſort muſt he take to make a compoſition worth 8s. per gallon?—Anſ. 64gal. each.

(11.) A grocer would mix teas at 12s. 8s. and 6s. per lb. with 28lb at 4s. 6d. per lb. What quantity of each muſt he take that the compoſition may be worth 7s. per lb?—Anſ. 14lb at 12s. $5\frac{1}{3}$lb at 8s. and $5\frac{1}{3}$lb at 6s.

(12.) A perſon is deſirous of mixing corn, at 4, 3, and 2, ſhillings per buſhel, with 24 buſhels of an inferior kind, worth 1s. 6d. per buſhel; how many buſhels of each muſt he take that he may afford to ſell the mixture at 3s. 4d. per buſhel?—Anſ. 126 buſhels at 4s. 24 buſhels at 3s. and 24 buſhels at 2s.

PROPOSITION IV.

Given the Rates, or Prices, of ſeveral Ingredients, the mean Rate, and the whole Quantity of the Mixture, to find the particular Quantities of each Sort; this is called Alligation Total.

Rule. Take the difference between each rate and the mean, as before.—Then, as the ſum of theſe differences is to the whole quantity of the mixture, ſo is each particular difference to its reſpective quantity.

(13.) A merchant propoſes to mix four ſorts of wine; the beſt at 14s. per gallon, the ſecond at 12s. the third at 9s. and the fourth at 8s. per gallon. How many of each will make a mixture of 12 gallons worth 10s. per gallon?

	s.	diff.						
10s.	14	1	=1	As 12d.	:	12 gal.	:: 1d. :	1 gal.
	12	1+2	=3	12d.	:	12 —	:: 3d. :	3 —
	9	4+2	=6	12d.	:	12 —	:: 6d. :	6 —
	8	2	=2	12d.	:	12 —	:: 2d. :	2 —
		Sum of the differences	12					Anſwer.

Note. Other anſwers may be obtained by linking the ſimples differently.—In order to give the ſcholar a clearer idea of this ſubject, I have given the ſame example to each of the propoſitions.

(14.) A grocer would mix four ſorts of ſugar, viz. at 2s. 1s. 8d. 1s. and 8d. per lb. What quantity of each muſt he take to make a compoſition of 72lb at 1s. 4d. per lb?—Anſ. 24lb at 2s. 12lb at 1s. 8d. 12lb at 1s. and 24lb at 8d.

(15.) It is required to mix brandy at 8s. 7s. and 1s. per gallon, with water at 0s. per gallon, ſo that a compoſition of 16 gallons thereof may be worth 5s. per gallon?—Anſ. $5\frac{1}{7}$ gal. at 8s. $4\frac{1}{7}$ at 7s. $2\frac{3}{7}$ at 1s. and $3\frac{3}{7}$ gal. of water.

(16.) How much gold, of 8, 9, and 24, carats fine, muſt be mixed together to make a compoſition of 64 oz. of 14 carats fine?—Anſ. $22\frac{22}{31}$ carats of 24 carats fine, $20\frac{20}{31}$ carats at 9, and $20\frac{20}{31}$ at 8 carats fine.

(§. 2.) PO-

(§. 2.) POSITION.

Definition. *The Rule of Position*, or trial and error, is ſo called becauſe we ſuppoſe ſome uncertain number, or numbers; and, by reaſoning from them according to the nature of the queſtion, and paying proper attention to the error, or errors, obtain a true anſwer.

(§. 3.) SINGLE POSITION.

Definition. *By ſingle Poſition*, or a ſingle ſuppoſition, are ſolved thoſe queſtions wherein the reſults are proportional to their ſuppoſitions.

Rule. Suppoſe ſome convenient number, and proceed with it according to the nature of the queſtion; then, if the reſult be either too much or too little, ſay, as the falſe number reſulting is to the true number given, ſo is the whole, or any part, of the ſuppoſed number to the whole, or correſponding part, of the required number.

(1.) A drover, being aſked how many ſheep he had got, replied, if, Sir, you add $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$, of the number together, the ſum will be 18. How many had he?

Suppoſe he had 12.

Then $\frac{1}{3}$ of 12 = 4
$\frac{1}{4}$ of ditto = 3
$\frac{1}{6}$ of ditto = 2

The ſum is 9 but ſhould be 12.

Hence, as 9 : 18 :: 12 : 24 ſheep, anſwer.

(2.) Three perſons are to pay a reekoning of 20l. A is to pay $\frac{1}{2}$, B $\frac{1}{3}$, and C $\frac{1}{4}$; how much muſt each perſon pay of the reckoning? Anſ.

9l. 4s. $7\frac{1}{4}$d. $\frac{7}{13}$ A's ſhare.
6 3 $0\frac{3}{4}$ $\frac{9}{13}$ B's ſhare.
4 12 $3\frac{1}{2}$ $\frac{10}{13}$ C's ſhare.

(3.) A can do a piece of work in 7 days, B can do the ſame in 5, and C in 6. Set them all at work together, in what time will they finiſh it?—Anſ. $1\frac{103}{107}$.

(4.) One-fifth part of an army were killed in battle, $\frac{1}{6}$ part were taken priſoners, and $\frac{1}{10}$ part died by ſickneſs; if 4000 men were leſt, how many did the army conſiſt of?—Anſ. 7500 men.

(5.) I have a ciſtern which has three cocks, D, E, and F. Now, if D be opened by itſelf, when the ciſtern is full, it will empty it in 9 hours; if E be opened by itſelf, it will empty the ciſtern in 11 hours; and if F be opened by itſelf, it will empty the ciſtern in 13 hours. In what time will they empty the ciſtern if I ſet them all open together?—Anſ. $3\frac{210}{339}$ hours.

(6.) A perſon delivered to another a ſum of money, to receive intereſt for the ſame at 4 per cent. per annum, (ſimple Intereſt.) At the end of 3 years he received for principal and intereſt 176l. 8s. What was the ſum lent?—Anſ. 157l. 10s.

(§. 4.) DOUBLE POSITION.

Definition. *By Double Poſition*, or two ſuppoſitions, are ſolved thoſe queſtions wherein the reſults are diſproportional to their ſuppoſitions.

Rule. Suppoſe any two convenient numbers, and proceed with them according to the nature of the queſtion, marking the errors (with + or —) according as they exceed or fall ſhort of the truth.

Then,

Multiply the firſt ſuppoſition by the ſecond error, and the ſecond ſuppoſition by the firſt error, and divide the ſum of the products by the ſum of the errors, if they are differently marked, or the difference of the products by the difference of the errors if they are marked alike, and the quotient will be the number ſought.

Or, II.

Multiply the difference between the two ſuppoſed numbers by the leſs error, and divide the product by the ſum of the errors

errors, if they are differently marked; or by the difference if they are marked alike; and the quotient will be a correction of the number belonging to the leſs error, and muſt be added to it, if that error be leſs than the truth, or ſubtracted, if it be greater.

(1.) What number is that, which, being multiplied by 3, the product increaſed by 4, and that ſum divided by 8, the quotient may be 32?

Suppoſe 12	Again, ſuppoſe 108
×3	×3
36	324
+4	+4
8) 40	8) 328
Quotient 5	Quotient 41
ſhould be 32	ſhould be 32
Error — 27	Error + 9

By Rule 1.

	its error	
1ſt ſuppoſition 12	×	— 27
2d ſuppoſition 108	×	+ 9
27	its error	12
2916		108
108		

27+9=36) 3024 (84 anſwer.
144

By Rule 2.

$\frac{108 - 12 \times 9}{27+9} = 24$, correction of the number (108) belonging to the leſs error. Hence 108—24=84, as before.

(2.) A man has two excellent horſes;—and a ſingle-horſe chaiſe and furniture, worth 150l. Now, if the firſt horſe be put in the chaiſe, his value, with the furniture, &c. will be three times that of the ſecond horſe without it; but, if the ſecond horſe be put in the chaiſe, his value will be double that

the firſt, what are the horſes worth?—Anſ. 120l. value of the firſt horſe; and 90l. value of the ſecond.

(3.) A perſon being aſked the time of the day, replied, the day is now 16 hours long, and the ſun riſes at four o'clock. Now, if you add $\frac{1}{2}$ of the hours that have paſſed ſince the ſun roſe to $\frac{3}{4}$ of thoſe which muſt elapſe before the ſun ſets, you will have the exact time of the day?—Anſ. 24 min. paſt 10 o'clock in the morning.

(4.) A perſon received 11 crowns and 7 dollars for a debt of 4l. 10s. 10d. and at another time received 4 crowns and 3 dollars for a debt of 1l. 15s. What was the value of a crown and a dollar in Engliſh money?—Anſ. 5s. 6d. value of a crown, and 4s. 4d. value of a dollar.

(5.) A perſon diſtributed in charity 2d. a piece among ſeveral poor children, and had 4d. left. He would have given them 3d. a piece, but wanted 10d. to be able to do it. What was the number of children?—Anſ. 14 children.

(§. 5.) ARITHMETICAL PROGRESSION.

Definition. When a ſeries of numbers increaſes, or decreaſes, by an equal exceſs, or difference, thoſe numbers are ſaid to be in *arithmetical Progreſſion*; ſuch as

2, 4, 6, 8, 10, &c. or 15, 14, 13, 12, 11, &c.

and the numbers which form ſuch ſeries are called the terms of the progreſſion. The firſt and laſt terms are uſually called the extremes.

Note 1. If three numbers are in arithmetical progreſſion, the ſum of the extremes will be equal to double the mean; and the product of the extremes, increaſed by the ſquare of the common difference, will be equal to the ſquare of the mean. Thus, if 5, 7, 9, are in arithmetical progreſſion, then will $5+9=7\times2$, and $9\times5+2\times2=7\times$.

2. If four numbers are in arithmetical progreſſion, the ſum of the two extremes will be equal to the ſum of the means.

Thus, if 2, 5, 8, 11, are in arithmetical progreſſion,

Then will $2+11=5+8$.

3. If a ſeries of numbers, (conſiſting of any number of terms,) are in arithmetical progreſſion, the ſum of the extreme will always be equal to the ſum of any two means equidiſtant from the extremes; or to double the mean if the terms be odd.

Thus, if 3, 5, 7, 9, 11, 13, &c. are in arithmetical progreſſion,

Then will $3+13=5+11=7+9$.

Or, if 1, 4, 7, 10, 13, &c. are in arithmetical progreſſion, then will $1+13=4+10=7\times2$.

PRO-

PROPOSITION I.

Given the leaſt Term, the greateſt Term, and the Number of Terms, of an arithmetical Progreſſion, to find the Sum of the Terms.

Rule. To the leaſt term add the greateſt, multiply the ſum by half the number of terms, and the product will be the ſum of the terms.

(1.) If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 4, the greateſt 100, and the number of terms 17, what is the ſum of the terms?

$4+100=104$, and $104\times\frac{17}{2}=884$, anſwer.

(2.) If the leaſt term be 3, the greateſt 108, and the number of terms 14, what is the ſum of the terms?—Anſ. 777.

(3.) How many ſtrokes does the hammer of a clock ſtrike in 12 hours?—Anſ. 78.

(4.) If 100 ſtones be laid in a right line, and exactly the ſpace of a yard be left between one ſtone and another, how far muſt a perſon travel who gathers up theſe ſtones ſingly, returning with every one to a baſket a yard diſtant from the firſt?—Anſ. 5 miles, 1300 yards.

PROPOSITION II.

Given the leaſt Term, the greateſt Term, and the Number of Terms, to find the common Exceſs, or Difference.

Rule. Divide the difference between the greateſt and the leaſt term by the number of term leſs unity, and the quotient will be the common exceſs, or difference.

(5.) If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 4, the greateſt 100, and the number of terms 17, what is the common difference between each term?

100—4=96 diviſor, and 17—1=16 dividend; hence 96 divided by 16 gives 6, the common difference.

(6.) If the leaſt term be 3, the greateſt 108, and the number of terms 14, what is the common difference?—Anſ. $8\frac{1}{13}$.

(7.) A

(7.) A perſon travelled from London to a certain place in 8 days; he travelled 2 leagues the firſt day, and every day he travelled farther than he did the preceeding by an equal number of leagues; the laſt day he travelled 23 leagues: how far did he travel every day?—Anſ. 3, the common difference between each day's journey, ſo that he travelled 2 leagues the firſt day, 5 the ſecond, 8 the third, &c.

PROPOSITION III.

Given the leaſt Term, the greateſt Term, and the common Exceſs, or Difference, to find the Number of Terms.

Rule. Divide the difference between the greateſt and the leaſt term, by the common exceſs, or difference, the quotient, increaſed by an unit, will give the number of terms.

(8.) The leaſt term of a ſeries of numbers in arithmetical progreſſion is 4, the greateſt 100, and the common difference between each term is 6; what is the number of terms?

100—4=96 dividend, which, divided by 6, gives 16 for the quotient; which, increaſed by an unit, gives 17 for the number of terms.

(9.) If the leaſt term be 3, the greateſt 108, and the common difference 5, what is the number of terms?—Anſ. 22.

(10.) A man, going a journey, travelled the firſt day 2 leagues, and the laſt day 23; he increaſed his journey every day 3 leagues; how many days did he travel?—Anſ. 8.

PROPOSITION IV.

Given the greateſt Term, the Number of Terms, and the common Exceſs, or Difference, to find the leaſt Term.

Rule. Multiply the common exceſs, or difference, by the number of terms leſs 1; ſubtract the product from the greateſt term, and the remainder will be the leaſt term.

(11.) The greateſt term of a ſeries of numbers in arithmetical progreſſion is 100, the number of terms 17, and the common difference between each term 6; what is the leaſt term?

17 — 1 × 6=96; then 100—96 = 4, anſwer.

(12.) If

(12.) If the greateſt term be 108, the number of terms 22, and the common difference 5, what is the leaſt term?—Anſ. 3.

(13.) A man in 6 days went from London to a certain place; every day's journey was greater than the preceding one by 4 miles; his laſt day's journey was 40 miles: what was his firſt?—Anſ. 20 miles.

PROPOSITION V.

Given the Number of Terms, the common Exceſs, or Difference, and the Sum of the Terms, to find the leaſt Term.

Rule. Divide the ſum of the terms by the number of terms; and, from the quotient, ſubtract half the product of the common exceſs, or difference, by the number of terms leſs 1, the remainder will be the leaſt term.

(14.) The number of terms is 17, the common difference 6, and the ſum of the terms, of a ſeries of numbers in arithmetical progreſſion, is 884; what is the leaſt term?

$884 \div 17 = 52$, and $\overline{17-1} \times 6 = 96$; then $52 - \frac{96}{2} = 4$, the leaſt term.

(15.) If the number of terms be 22, the common difference 5, and the ſum of the terms 1221, what is the leaſt term?—Anſ. 3.

(16.) A man is to receive 300l. at 12 payments, each ſucceeding payment to exceed the former by 4l. What will his firſt payment be?—Anſ. 31.

PROPOSITION VI.

Given the leaſt Term, the Number of Terms, and the common Exceſs, or Difference, to find the greateſt Term.

Rule. Multiply the number of terms by the common exceſs, or difference, and to that product add the leaſt term; from this ſum ſubtract the common exceſs, or difference, and the remainder will be the greateſt term.

(17.) If the leaſt term of a ſeries of numbers in arithmetical progreſſion be 4, the number of terms 17, and the common difference 6, what is the greateſt term?

$17 \times 6 = 102$, and $102 + 4 = 106$; then $106 - 6 = 100$, the greateſt term.

18.) If

(18.) If the leaſt term be 3, the number of terms 22, and the common difference 5, what is the greateſt term?—Anſ. 108.

(19.) A man bought 200 yards of cloth; the firſt yard coſt him 2s. and each ſucceeding yard 1s. more to the laſt; what did the laſt yard ſtand him in?—Anſ. 5l. 1s.

(§. 6.) GEOMETRICAL PROGRESSION.

Definition. When a ſeries of numbers increaſes by a common multiplier, or decreaſes by a common diviſor, thoſe numbers are ſaid to be in *geometrical Progreſſion*; ſuch as 2, 4, 8, 16, &c. or 27, 9, 3, 1, &c. The firſt and laſt terms are uſually called the extremes, and the common multiplier or diviſor the ratio.

Note 1. If three numbers are in geometrical progreſſion, the product of the two extremes will be equal to the ſquare of the mean.

Thus, if 3, 9, 27, are in geometrical progreſſion,
Then will $3\times27=9\times9$.

2. If four numbers are in geometrical progreſſion, the product of the two extremes will be equal to the product of the means.

Thus, if 2, 4, 8, 16, are in geometrical progreſſion,
Then will $2\times16=4\times8$.

3. If a ſeries of numbers (conſiſting of any number of terms) is in geometrical progreſſion, the product of the two extremes will be equal to the product of any two means equidiſtant from the extremes; or to the ſquare of the mean, if the terms be odd.

Thus, if 1, 2, 4, 8, 16, 32, &c. are in geometrical progreſſion,
Then will $1\times32=2\times16=4\times8$.

Or if 1, 2, 4, 8, 16, &c. are in geometrical progreſſion,
Then will $1\times16=2\times8=4\times4$.

PROPOSITION I.

In any Series of Numbers in geometrical Progreſſion, where the firſt, or leaſt Term is equal to the Ratio:—Given the firſt, or leaſt, Term, the Number of Terms, and the Ratio, to find the greateſt, or any remote, Term, without finding all the intermediate ones.

Rule. Write down a few of the leading terms in the geometrical ſeries, over which place the arithmetical ſeries,

1, 2,

1, 2, 3, 4, 5, &c. as indices: find what figures of theſe indices, added together, will give the index of the term wanted in the geometrical ſeries; then multiply the numbers ſtanding under ſuch indices into each other, and their product will be the term ſought.

Thus, 1, 2, 3, 4, 5, 6, &c. indices.
3, 9, 27, 81, 243, 729, &c. geometrical ſeries.

(1.) The firſt, or leaſt, term of a ſeries of numbers in geometrical progreſſion is 3, the ratio 3, and the number of terms 14, what is the greateſt, or laſt, term?

1 . 2 . 3 . 4 . 5, &c. indices.
3 . 9 . 27 . 81 . 243, &c. leading terms.
5 + 5 + 4 = 14, index to the 14th term.
243 × 243 × 81 = 4782969, laſt, or 14th, term.

(2.) If the firſt, or leaſt, term be 2, the ratio 2, and the numbers of terms 19, what is the laſt, or greateſt term?—Anſ. 524288.

(3.) A draper ſold 20 yards of cloth; the firſt yard for 3d. the ſecond for 9d. the third for 27d. &c. in triple proportion geometrical; what did he ſell the laſt yard for;—Anſ. 3416784401d.

PROPOSITION II.

In any Series of Numbers in geometrical Progreſſion, where the firſt, or leaſt, Term is different from the Ratio;—Given the firſt, or leaſt, Term, the Number of Terms, and the Ratio, to find the greateſt, or any remote, Term, without finding all the intermediate ones.

Rule. Write down a few of the leading terms in the geometrical ſeries, over which place the arithmetical ſeries, 0, 1, 2, 3, 4, 5, 6, &c. as indices: add together the moſt convenient indices to make an index, an unit leſs than the index of the term required: then multiply the numbers ſtanding under ſuch indices into each other, taking care to divide the product of every two by the firſt term in the geometrical ſeries, and the laſt quotient will be the term required.

Thus, 0, 1, 2, 3, 4, 5, &c. indices.
5, 10, 20, 40, 80, 160, &c. geometrical ſeries.

(4.) The

(4.) The firſt, or leaſt, term of a geometrical ſeries is 5, the ratio 3, and the number of terms 12; what is the laſt, or greateſt, term?

0 . 1 . 2 . 3 . 4, &c. indices.
5 . 15 . 45 . 135 . . 405, &c. leading terms.

$4 + 4 = 8$ index to the 9th term.

$405 \times 405 = 32805$ the 9th term.

$8 + 3 = 11$ index to the 12th term.

$\frac{32805 \times 135}{5} = 885735$ the 12th term.

(5.) If the firſt, or leaſt, term be 7, the ratio 2, and the number of terms 19, what is the laſt, or greateſt, term?—Anſ. 1835008.

(6.) A thraſher worked 20 days for a farmer, and received (by agreement) for the firſt day's work 4 barley-corns, for the ſecond 12, for the third 36, &c. in triple proportion geometrical; what did he receive for his laſt day's work, admitting the barley to be worth 2s. 6d. per buſhel?—Anſ. 11821. 6s. 3d.

PROPOSITION III.

Given the firſt, or leaſt, Term, the Ratio, and the Number of Terms, to find the Sum of the Terms.

Rule. Find the laſt, or greateſt, term by one of the preceding rules, from which ſubtract the firſt, or leaſt, term, and divide the remainder by the ratio, leſs 1; the quotient, increaſed by the laſt, or greateſt, term, will give the ſum of the ſeries.

(7.) If the firſt term of a ſeries of numbers in geometrical progreſſion be 5, the ratio 3, and number of terms 12, what is the ſum of the terms?

The laſt, or greateſt, term (by example 4.) is 885735.
Then $885735 - 5 = 885730$ dividend;
And $3 - 1 = 2$ diviſor. Hence $885730 \div 2 = 442865$;
and $442865 + 885735 = 1328600$, ſum of the terms.

(8.) If the firſt term be 4, the ratio 3, and the number of terms 7, what is the ſum of the terms?—Anſ. 4372.

(9.) What

Examples, exerciſing all the preceding Propoſitions.

(9.) What would a horſe be ſold for that has 4 ſhoes on, with 8 nails in each ſhoe, at 1 farthing for the firſt nail, 2 for the ſecond, 4 for the third, &c. And, ſuppoſing another horſe to be ſold with only 2 ſhoes on, on the ſame conditions, what would be the difference in their prices?—Anſ. 44739241. 5s. $3\frac{3}{4}$d. value of the firſt horſe; and 681. 5s. $3\frac{3}{4}$d. value of the ſecond; the difference of the values is 44738561.

(10.) If a ſervant ſhould agree with his maſter to ſerve him 11 years, without any other reward than the produce of a wheat-corn for the firſt year; and, for the ſecond year, ground ſufficient to ſow his firſt year's produce on, &c. from year to year, till the end of the time, what would his wages amount to, admitting each wheat-corn to yield 10 by ſowing, and that he could ſell his wheat at 4s. per buſhel?—Anſ. 452111. 4s. $6\frac{1}{4}$d.

(11.) A nobleman dying left 10 ſons, to whom and to his executor he bequeathed his eſtate as follows; to his executor he gave 1024l. the youngeſt ſon was to have as much and half as much, and every ſon to ſucceed the next younger in the ſame ratio of $1\frac{1}{2}$; what was the eldeſt ſon's fortune, and what did the nobleman die worth?—Anſ. 590491. the eldeſt ſon's fortune, and 880611. 10s. the nobleman died worth.

(§. 7.) VARIATIONS.

Definition. *By Variations* are meant the different ways any number of things may be altered, or changed, with reſpect to their places. Theſe are ſometimes called *Changes, Permutation, Alternation,* &c.

PROPOSITION I.

To find the Number of Changes that can be made of any given Number of Things, all different from each other.

Rule. Multiply continually together the numbers 1, 2, 3, 4, 5, &c. to the number of terms; and the laſt product will be the anſwer.

(1.) How many changes may be rung by 8 bells?

$1\times2\times3\times4\times5\times6\times7\times8=40320$, anſwer.

(2.) How many changes may be rung on 9 bells?—Anſ. 362880.

(3.) An arithmetician aſked a farmer with whom he lodged what he ſhould give him per annum for board and lodging; the farmer aſked him 25l. The arithmetician ſaid that was ſomewhat dear; however, he would give him that ſum if he would find him with board and lodging ſo long as he could place himſelf and the honeſt farmer's family (conſiſting of 6 perſons) in a different poſition at dinner. How long might he ſtay for 25l.? Anſ. 13 years, 295 days.

(4.) How many changes may be rung on 12 bells, and how long would they take in ringing once over, ſuppoſing 10 changes to be rung in a minute, and the year to conſiſt of 365 days 6 hours?—Anſ. 91 years, 26 days, 6 hours, ringing without intermiſſion.

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SCHOLAR's EASY GUIDE

TO

ARITHMETIC.

PART IV.

VULGAR FRACTIONS.

Definitions.

1. *FRACTIONS*, or broken numbers, are expressions for any assignable part of an unit, and are represented by two numbers, placed one above the other, with a line drawn between them, as $\frac{3}{4}$. The lower number is called the denominator, and shews how many parts the integer is divided into; the upper number is called the numerator, and shews how many of those parts are meant by the fraction.

2. *A proper Fraction* is that wherein the numerator is less than the denominator, as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, &c.

3. *An improper Fraction* is that wherein the numerator is greater than, or equal to, the denominator, as $\frac{5}{4}$ or $\frac{5}{5}$.

4. *A single, or simple, Fraction* is that which consists of but one numerator and denominator, as $\frac{5}{6}$.

5. *A Com-*

5. *A Compound Fraction*, or fraction of a fraction, consists of two, or more, fractions connected with the word *of*, as $\frac{1}{2}$ of $\frac{3}{4}$ of $4\frac{1}{3}$, &c.

6. *A mixed Number* is a whole number with a fraction annexed, as $17\frac{1}{2}$, $14\frac{5}{8}$, &c.

7. *The common Measure of a Fraction* is that which will divide both the numerator and denominator without a remainder.

8. The numerator and denominator are in general called the *terms* of the fraction, viz. the numerator is called the upper term, and the denominator the lower term.

(§. 1.) REDUCTION of VULGAR FRACTIONS.

PROPOSITION I.

To find the greatest common Measure of a Fraction.

Rule. Divide the greater term by the less, and this divisor by the remainder, continually, till there is no remainder; then the last divisor will be the greatest common measure of both terms of the fraction, or of any two numbers whatever.

(1.) Find the greatest common measure to $\frac{216}{408}$. Or, in other words, find the greatest number that will divide 216 and 408 without a remainder.

216) 408 (1
216

192) 216 (1
192

24) 192 (8
192

Common measure

(2.) Find the greatest common measure to $\frac{342}{684}$.—Ans. 3.
(3.) Find the greatest common measure to $\frac{600}{1200}$.—Ans. 6.
(4.) Find the greatest common measure to $\frac{243}{450}$.—Ans. 9.
(5.) Find the greatest common measure to $\frac{3750}{4500}$.—Ans. 375.

PRO-

Proposition II.

To abbreviate, or reduce, Fractions to their loweſt Terms.

Rule. Divide the terms of the given fraction by any number that will divide them without a remainder, and theſe quotients again in the ſame manner; and ſo on till no number greater than 1 will divide them. Or, divide both the terms of the fraction by their greateſt common meaſure.

Note 1. Any number, ending with an even number or a cipher, is diviſible by 2.

2. Any number ending with 5 or 0, is diviſible by 5.

3. If any fraction has ciphers at the right hand of its terms, it may be abbreviated by cutting off the ciphers, as $\frac{4}{5}\frac{0}{0}=\frac{4}{7}$.

4. If any number ending with 1, 3, 7, or 9, be the numerator or denominator of a fraction, and will not divide by 3, 7, or 9, that fraction is generally in its loweſt terms.

(6.) Reduce $\frac{216}{408}$ to its loweſt term.

$\frac{216}{408}\overset{\div 3}{=}\frac{72}{136}\overset{\div 4}{=}\frac{18}{34}\overset{\div 2}{=}\frac{9}{17}$ anſwer.—Or the common meaſure, (by example 1) is 24: hence $24)\ \frac{216}{408}=\frac{9}{17}$ as before.

(7.) Reduce $\frac{374}{1080}$ to its loweſt terms.—Anſ. $\frac{187}{540}$.
(8.) Reduce $\frac{410}{510}$ to its loweſt terms.—Anſ. $\frac{41}{51}$.
(9.) Reduce $\frac{3435}{17745}$ to its loweſt terms.—Anſ. $\frac{69}{1450}$.
(10.) Reduce $\frac{8343}{9747}$ to its loweſt terms.—Anſ. $\frac{709}{1361}$.
(11.) Reduce $\frac{5429}{7143}$ to its loweſt terms.—Anſ. $\frac{1663}{2311}$.

Proposition III.

To reduce a whole Number to an equivalent Fraction of a given Denominator.

Rule. Multiply the whole number by the given denominator, and the product will be the numerator required.

Note. Any whole number may be expreſſed like a fraction by writing 1 under it for a denominator. Thus, $5=\frac{5}{1}$.

(12.) Reduce 14 to an improper fraction, having 9 for its denominator.

$14\times 9=126$ numerator; hence $14=\frac{126}{9}$ the fraction required.

(13.) Reduce 15 to an improper fraction, having 26 for its denominator.—Anſ. $\frac{390}{26}$.

(14.) Reduce 34 to an improper fraction, having 91 for its denominator.—Anſ. $\frac{3094}{91}$.

PROPOSITION IV.

To reduce a mixed Number to its equivalent improper Fraction.

Rule. Multiply the whole number by the denominator of the fraction, and to the product add the numerator; this ſum, written above the denominator, will form the fraction required.

(15.) Reduce $25\frac{3}{8}$ to its equivalent improper fraction.

$25\frac{3}{8}$ denominator of the fraction.

203 new numerator. Then $25\frac{3}{8} = \frac{203}{8}$.

(16.) Reduce $149\frac{5}{9}$ to an improper fraction.—Anſwer $\frac{1346}{9}$.

(17.) Reduce $375\frac{94}{99}$ to an improper fraction.—Anſwer $\frac{37219}{99}$.

(18.) Reduce $17494\frac{1443}{99999}$ to an improper fraction.—Anſ. $\frac{1740383049}{99999}$.

(19.) Reduce $4734\frac{37}{95}$ to an improper fraction.—Anſwer $\frac{449787}{95}$.

(20.) Reduce $1789\frac{5}{9}$ to an improper fraction.—Anſwer $\frac{16106}{9}$.

*(21.) Reduce $55\frac{4}{7}$ to an improper fraction.—Anſwer $\frac{389}{7}$.

PROPOSITION V.

To reduce an improper Fraction to its equivalent whole or mixed Number.

Rule. Divide the numerator by the denominator, and the quotient will be the whole or mixed number required.

(22.) Re-

(22.) Reduce $\frac{375}{13}$ its equivalent whole or mixed number.

Every fraction denotes a diviſion of its numerator by the denominator, therefore 375 divided by 12 = $28\frac{11}{13}$, anſwer.

(23.) Reduce $\frac{4790}{25}$ to a whole or mixed number.—Anſ. $191\frac{3}{5}$.

(24.) Reduce $\frac{1512}{108}$ to a whole or mixed number.—Anſ. 14.

(25.) Reduce $\frac{375941}{999}$ to a whole or mixed number.—Anſ. $763\frac{314}{999}$.

(26.) Reduce $\frac{3745174}{349}$ to a whole or mixed number.—Anſ. 10731 $\frac{55}{349}$.

Proposition VI.

To find the leaſt common Multiple of two or more Numbers, or to find the leaſt Number that can be divided by two or more given Numbers, without a Remainder.

Rule. Divide the given numbers by any number that will divide two or more of them without a remainder, and ſet the quotients, together with the undivided numbers, in a line underneath; divide this ſecond line as before, and ſo on till there are no two numbers that can be divided, then the continual products of the diviſors and quotients will give the multiple required.

*(27.) Find the leaſt number that can be divided by 2, 3, 4, 5, and 6, without a remainder.

2	2, 3, 4, 5, 6
3	1. 3. 2. 5. 3
	1. 1. 2. 5. 1

Then $2 \times 3 \times 2 \times 5 = 60$ the anſwer.

*(28.) Find the leaſt number that can be divided by 4, 6, and 10, without a remainder.—Anſ. 60.

*(29.) Find the leaſt number that can be divided by 2, 3, 4, 5, 6, and 7, without a remainder.—Anſ. 420.

*(30.)

*(30.) Find the leaſt common multiple of 3, 4, 8, and 12.—Anſ. 24.

*(31.) Find the leaſt number that can be divided by 1, 2, 3, 4, 5, 6, 7, 8, and 9. without a remainder.—Anſ. 2520.

*(32.) Find the leaſt number that can be divided by 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20, without a remainder.—Anſ. 232792560.

PROPOSITION VII.

To reduce a compound Fraction to a ſimple one.

RULE.

If any of the propoſed Quantities be integers, or mixed numbers, reduce them to their proper terms. Then multiply all the numerators together for a new numerator, and all the denominators for a new denominator. Reduce this new fraction to it loweſt terms.

(33.) Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $5\frac{3}{8}$ of $\frac{68}{486}$ of 3 to a ſingle fraction.

Firſt, $5\frac{3}{8} = \frac{43}{8}$; and $3 = \frac{3}{1}$.

Then $\frac{1 \times 2 \times 43 \times 68 \times 3}{2 \times 3 \times 8 \times 486 \times 1} = \frac{17544}{23328} = \frac{731}{972}$ anſwer.

Or, rather,

$$\frac{1}{\cancel{2}} \times \frac{\cancel{2}}{\cancel{3}} \times \frac{43}{\cancel{8}_{2}} \times \frac{\cancel{68}^{17}}{486} \times \frac{\cancel{3}}{1} = \frac{43 \times 17}{486 \times 2} = \frac{731}{972}$$ as before.

(34.) Reduce the $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{1}{5}$ of $\frac{27}{101}$ of $\frac{5}{13}$ to a ſingle fraction.—Anſ. $\frac{375}{10504}$.

(35.) Reduce $\frac{41}{110}$ of $\frac{3}{19}$ of $\frac{41}{108}$ of $\frac{1}{7}$ to a ſingle fraction.—Anſ. $\frac{1681}{175560}$.

(36.) Reduce $3\frac{1}{8}$ of $\frac{2}{5}$ of $\frac{27}{301}$ of 49 to a ſingle fraction.—Anſ. $\frac{3045}{344}$.

(37.) Reduce $3\frac{4}{7}$ of $\frac{47}{53}$ of $\frac{304}{1716}$ of 108 to a ſingle fraction.—Anſ. $\frac{970785}{2261}$.

(38.) Re-

(38.) Reduce $\frac{34}{59}$ of $\frac{1}{13}$ of $\frac{205}{504}$ of 34 to a ſingle fraction.
—Anſ. $\frac{39593}{22184}$.

PROPOSITION VIII.

To reduce Fractions of different Denominators to others of equal Value, having a common Denominator.

1. *General Rules.*

When any of the propoſed quantities are integers, mixed numbers, or compound fractions, they muſt be reduced to their proper terms by the preceding rules. Then multiply each numerator into all the denominators, except its own, for a new numerator, and all the denominators together for a common denominator.

Or, II.

Multiply all the denominators, of the given fraction, together for a common denominator.

Then divide the common denominator by each of the given denominators ſeparately, and multiply the quotients by their ſeveral numerators, the products will be the new numerators.

Or, III.

Find the leaſt number that can be divided by the ſeveral denominators of the given fractions, and it will be the common denominator.

Then divide this common denominator by each of the given denominators ſeparately, and multiply the quotient by their ſeveral numerators, the products will be the new numerators; and the fraction will have the leaſt common denominator poſſible.

(39.) Reduce $\frac{3}{4}$, $\frac{5}{7}$, and $\frac{3}{11}$, to a common denominator.

$3\times7\times11=231$
$5\times4\times11=220$ } new numerators.
$3\times7\times4=84$

$4\times7\times11=308$ common denominator.

Hence $\frac{3}{4}=\frac{231}{308}$; $\frac{5}{7}=\frac{220}{308}$; and $\frac{3}{11}=\frac{84}{308}$.

Otherwiſe

Otherwise, $4 \times 7 \times 11 = 308$, common denominator.

4)308	7)308	11)308
77	44	28
3	5	3
231 num.	220 num.	84 num.

Hence the new fractions are $\frac{231}{308}$, $\frac{220}{308}$, and $\frac{84}{308}$, as above.

(40.) Reduce $\frac{1}{5}$, $\frac{4}{9}$, $\frac{5}{8}$, and $\frac{11}{16}$, to a common denominator.—Anſ. $\frac{1152}{5760}$, $\frac{2560}{5760}$, $\frac{3600}{5760}$, and $\frac{3960}{5760}$.

(41.) Reduce $\frac{1}{2}$ of $\frac{1}{3}$ of $\frac{5}{8}$ and $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{3}{5}$ to a common denominator.—Anſ. $\frac{5}{28}$ and $\frac{9}{28}$.

(42.) Reduce $5\frac{1}{8}$, $3\frac{5}{7}$, $4\frac{1}{9}$, and $6\frac{5}{8}$, to improper fractions, having a common denominator.—Anſ. $\frac{20664}{4032}$, $\frac{14976}{4032}$, $\frac{16576}{4032}$, and $\frac{26712}{4032}$.

(43.) Reduce $\frac{4}{105}$, $\frac{171}{470}$, $\frac{512}{713}$, and $\frac{128}{923}$, to fractions, having the leaſt common denominator poſſible.——Anſwer $\frac{2785784}{73126830}$, $\frac{26605719}{73126830}$, $\frac{52218880}{73126830}$, and $\frac{10064768}{73126830}$.

(44.) Reduce $\frac{3}{5}$, $\frac{2}{3}$, $\frac{1}{7}$, and $\frac{1}{2}$, to a common denominator.—Anſ. $\frac{126}{210}$, $\frac{140}{210}$, $\frac{30}{210}$, and $\frac{105}{210}$.

(45.) Reduce $\frac{3}{8}$, $\frac{4}{7}$, of $\frac{1}{9}$, and $\frac{7}{8}$ of 19, to a common denominator, the leaſt poſſible.—Anſ. $\frac{189}{504}$, $\frac{288}{504}$, $\frac{280}{504}$, $\frac{441}{504}$, and $\frac{9576}{504}$.

PROPOSITION IX.

To find the proper Quantity, or Value, of a Fraction in the known Parts of an Integer.

Rule. Multiply the numerator by the number of parts of the next inferior denomination, which makes one of the denomination of your fraction, and divide the product by the denominator, the quotient will be the value of the fraction. If there be a remainder, multiply it by the next inferior denomination,

nomination, and divide by the denominator as before: proceed thus till you come to the loweſt denomination.

(46.) Required the value of $\frac{5}{8}$ of a £.

5
20
8)100
s. 12 – 4
12
8)48
Anſwer 12s. 6d.
6d.

(47.) Required the value of $\frac{5}{8}$ of a cwt

5
4
8)20
qrs. 2 – 4
28
8)112
Anſ. 2qr. 14lb.
14lb.

(48) What is the value of $\frac{3}{5}$ of a ſhilling?—Anſ. $6\frac{1}{2}$d. $\frac{2}{5}$.

(49) Reduce $\frac{3}{5}$ of a lb avoirdupois to its proper quantity.—Anſ. 7oz $1\frac{7}{5}$d.

(50) What is the value of $\frac{1}{2}$ of $\frac{6}{5}$ of a lb troy?—Anſ. 7oz 4 dwt.

(51) Reduce $\frac{3}{5}$ of a league to its proper quantity?—Anſ. 1m 6f 16p.

(52) Reduce $\frac{5}{8}$ of $\frac{3}{5}$ of an acre to its proper quantity.—Anſ. 1r 20p.

(53) What is the value of $\frac{3}{5}$ of 15 yards of cloth?—Anſ. 8yds 1qr $1\frac{2}{5}$n.

(54) What is the value of $\frac{7}{9}$ of a tun of wine?—Anſ. 3hhd 7gal.

(55) What is the value of $\frac{3}{11}$ of a butt of beer?—Anſ. 29 gal 1qt $1\frac{7}{11}$pt.

(56) What is the value of $\frac{7}{26}$ of a year?—Anſ. 14 weeks.

(57) What is the value of $\frac{3}{5}$ of a chaldron of coals?—Anſ. 20buſ.

(58) What is the value of $\frac{3}{7}$ of 13s. 4d.?—Anſ. 5s. 4d.

(59) What is the value of $\frac{3}{7}$ of 15cwt 3qr 14lb?—Anſ. 6cwt 3qr 6lb.

(60) What is value of $\frac{3}{8}$ of a ſolid yard?—Anſ. 10ft 216 inches.

(61) What quantity of ale is contained in $\frac{3}{9}$ of 15228 cubic inches?—Anſ. 30gal.

Proposition X.

To reduce Coins, Weights, Meaſures, &c. into Fractions.

Rule.

Reduce the coin, weight, meaſure, &c, into the loweſt name mentioned, for a numerator, under which ſet the number

ber of parts contained in an unit of the integer, to which the propoſed fraction is to be reduced for a denominator. Reduce the fraction to its loweſt terms.

(62) Reduce 7s. $6\frac{3}{4}$d. to the fraction of a pound.

7s. $6\frac{3}{4}$d.	20s.
12	12
90	240
4	4
363 farth. numerator.	960 farth. denominator.

Hence $\frac{363}{960} = \frac{121}{320}$£. the fraction required.

(63) Reduce 15s. 11d. to the fraction of a pound.—Anſ. $\frac{191}{240}$£.

(64) Reduce $5\frac{1}{9}$d. to the fraction of a ſhilling.—Anſ. $\frac{23}{54}$s.

(65) Reduce 1cwt 2qr 6lb 3oz $8\frac{8}{9}$dr to the fraction of a cwt.—Anſ. $\frac{14}{9}$cwt.

(66) Reduce 5oz $3\frac{1}{5}$dr. to the fraction of a lb troy.—Anſ. $\frac{281687}{460800}$ lb troy.

(67) Reduce 3qr $3\frac{1}{5}$n. to the fraction of an Engliſh ell.—Anſ. $\frac{3}{4}\frac{4}{5}$ ells Eng.

(68) Reduce 147 days 15 hours to the fraction of a year.—Anſ. $\frac{1181}{2920}$ years.

(69) What part of a pound is 15s. $9\frac{1}{2}$d.—Anſ. $\frac{379}{480}$£.

(70) What part of a groat is $\frac{2}{3}$ of three half-pence?—Anſ. Anſ. $\frac{1}{4}$ of a groat.

(71) What part of 1ccwt 1qr 12lb is 8cwt 1qr 25lb 1oz $7\frac{3}{11}$drs?—Anſ. $\frac{9}{11}$.

(72) Reduce 4bu $2\frac{2}{7}$pecks of corn to the fraction of a quarter.—Anſ. $\frac{4}{7}$qr.

(73) Reduce 1qr 3n to the fraction of a yard.—Anſ. $\frac{7}{16}$yd.

(74) Reduce 2 roods 15per to the fraction of an acre.—Anſ. $\frac{19}{32}$ acre.

PROPOSITION XI.

To reduce a Fraction of one Denomination to the Fraction of another Denomination of equal Value.

Rule. From a leſs to a greater denomination. Multiply the denominator by all the denominations, from that given to that

that ſought: and, from a greater to a leſs denomination, multiply the numerator by all the denominations, from the denomination given to that ſought.

(75) Reduce $\frac{2880}{7}$ of a farthing to the fraction of a pound.

Here a ſmall name is brought into a great.

Therefore $\frac{2880}{7} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{2880}{6720}$ of a £ $= \frac{3}{7}$ of a £.

(76) Reduce $\frac{3}{7}$ of a pound to the fraction of a farthing.

Here a great name is to be brought into a ſmall.

Hence $\frac{3}{7} \times \frac{20}{1} \times \frac{12}{1} \times \frac{4}{1} = \frac{2880}{7}$ of a farthing.

(77) Reduce $\frac{5}{7}$ of a penny to the fraction of a pound.—Anſ. $\frac{1}{336}$ £.

(78) Reduce $\frac{7}{300}$ of a pound to the fraction of a penny.—Anſ. $\frac{7}{4}$d.

(79) Reduce $\frac{1}{8}$ of a dwt to the fraction of a pound troy.—Anſ. $\frac{1}{2880}$lb.

(80) Reduce $\frac{1}{300}$ of a lb troy to the fraction of a dwt.—Anſ. $\frac{4}{5}$dwt.

(81) Reduce $\frac{4}{5}$ of a lb avoirdupois to the fraction of a cwt.—Anſ. $\frac{1}{140}$cwt.

(82) Reduce $\frac{1}{1960}$ of a cwt. to the fraction of a lb.—Anſ. $\frac{4}{7}$.

(83) Reduce $\frac{7}{7^{\text{r}}}$ of a week to the fraction of a ſecond.—Anſ. $\frac{4233600}{7^{\text{r}}}$ ſeconds.

(84) Reduce $\frac{11}{13}$ of a gallon of wine to the fraction of a hhd.—Anſ. $\frac{11}{819}$ hhds.

(§. 2.) ADDITION of VULGAR FRACTIONS.

Rule.

Reduce mixed numbers to improper fractions; compound fractions to ſimple ones; and fractions of different denominators to a common denominator. Then the ſum of the numerators, written over the common denominator, will be the ſum of the fractions required.

Note 1. If the fractions are of different denominations, reduce them to their proper quantities, (by prop. 9th, or reduce them to the ſame denomination by prop. 11th,) and then add them together.

2. When ſeveral mixed numbers, as $4\frac{3}{4}$, &c. are to be collected into one ſum, firſt add the fractions to the fractions, and, to the left hand of the ſum, join the ſum of the whole numbers.

(1) Add $3\frac{5}{7}$, $4\frac{5}{8}$, and $\frac{5}{11}$, together.

Firſt $3\frac{5}{7}=\frac{26}{7}$, $4\frac{5}{8}=\frac{37}{8}$. Then the fractions become $\frac{26}{7}$, $\frac{37}{8}$, and $\frac{5}{11}$.

$$\left.\begin{array}{l} 26\times 8\times 11 = 2288 \\ 37\times 7\times 11 = 2849 \\ 5\times 8\times 7 = 280 \end{array}\right\} \text{numerators.}$$

$$\frac{5417}{616}=8\tfrac{489}{616} \text{ anſwer.}$$

$7\times 8\times 11 = 616$

Or thus,

The ſum of $\frac{5}{7}$, $\frac{5}{8}$, and $\frac{5}{11}$, when reduced to a common denominator, is $\frac{1105}{616}=1\frac{489}{616}$. Then $3+4+1\frac{489}{616}=8\frac{489}{616}$, as before.

(2) Add $\frac{2}{5}$, $\frac{5}{8}$, and $\frac{3}{7}$, together.—Anſ. $1\frac{127}{280}$.

(3) Add $\frac{1}{5}$, of $\frac{3}{11}$ and $5\frac{3}{8}$ together.—Anſ. $5\frac{189}{440}$.

(4) Add $\frac{1}{9}$, $7\frac{5}{8}$, $\frac{495}{1041}$ and $\frac{2140}{14157}$, together. — Anſwer $8\frac{14257001}{39299832}$.

(5) Add $\frac{1}{9}$ of $\frac{3}{5}$, $\frac{3}{4}$ of 19, and $\frac{5}{8}$ of 12, together.—Anſ. $21\frac{49}{60}$.

(6) Add $\frac{3}{5}$ and $\frac{9}{10}$ of $\frac{5}{11}$ of $15\frac{3}{8}$, together.—Anſwer $6\frac{783}{880}$.

(7) Add $\frac{5}{9}$ of a pound, $\frac{3}{8}$ of a ſhilling, and $\frac{3}{7}$ of a penny together Anſ. 11s. $6\frac{1}{2}$d. $\frac{4}{21}$.

(8) What is the ſum of $\frac{3}{4}$ of 1l. 10s. $\frac{1}{4}$ of 3l. 10s. and $\frac{1}{50}$ of a hundred guineas?—Anſ. 4l 2s.

(9) Add $\frac{1}{5}$ of a lb troy to $\frac{1}{8}$ of an ounce.—Anſ. 2 oz $10\frac{1}{2}$ dwt.

(10) Add $\frac{4}{5}$ of a ton to $\frac{5}{12}$ of a cwt.—Anſ. 9cwt 1qr $6\frac{2}{5}$lb.

(11) Add $\frac{5}{6}$ of 3 ells Engliſh to $\frac{5}{12}$ of a yard.—Anſ. 2 ells Engliſh, $4\frac{1}{6}$qr.

(12) Add $\frac{2}{5}$ of a yard, $\frac{3}{7}$ of a foot, and $\frac{5}{11}$ of a mile together.—Anſ. 3fur 35p $3\frac{33}{70}$yds.

(13) Add

(13) Add $\frac{5}{8}$ of an acre, $\frac{3}{5}$ of 19 ſquare feet, and $\frac{3}{7}$ of a ſquare inch, together.—Anſ. 2r 20p 11ft $58\frac{1}{35}$ inch.

(14) What is the ſum of $\frac{3}{4}$ of a tun of wine and $\frac{3}{5}$ of a hhd?—Anſ. $226\frac{4}{5}$gal.

(15) Add $\frac{3}{5}$ of a chaldron to $\frac{3}{7}$ of a buſhel.—Anſ. $20\frac{3}{7}$ buſh.

(16) Add $\frac{1}{4}$ of a week, $\frac{1}{3}$ of a day, and $\frac{1}{5}$ of an hour, together.—Anſ. 2d 2hrs.

(17) Add $\frac{1}{5}$ of $\frac{3}{4}$ of a year, $\frac{3}{8}$ of $\frac{5}{9}$ of a day, and $\frac{7}{8}$ of $\frac{3}{5}$ of $19\frac{1}{2}$ hours, together.—Anſ. 55d. $9\frac{1}{16}$hrs.

(§. 3.) SUBTRACTION of VULGAR FRACTIONS.

RULE.

Reduce mixed numbers to improper fractions; compound fractions to ſimple ones; and fractions of different denominators to a common denominator. Then the difference of the numerators, written above the common denominator, will give the difference of the fractions required.

Note 1. If the fractions are of different denominations, reduce them as directed in note 1 in addition, and then take their difference.

2. In ſubtracting mixed numbers, when the lower fraction is greater than the upper, ſubtract the numerator of the lower fraction from the denominator of the upper, and to their difference add the numerator of the upper fraction, carrying one to the unit's place of the lower whole number.

3. When a fraction is to be ſubtracted from an unit, ſubtract the numerator from the denominator; the remainder will be the numerator to be placed over the denominator.

4. When a proper fraction is to be ſubtracted from any whole number, ſubtract the numerator from the denominator for the numerator of the remainder, which muſt be annexed to the whole number, made leſs by 1.

(1) From $\frac{3}{4}$ take $\frac{5}{11}$.

$3\times11=33$
$5\times4=20$ } numerators.

13 difference.

$4\times11=44$

Anſ. $\frac{13}{44}$.

(2) What is the difference between $\frac{3}{5}$ and $\frac{9}{10}$?—Anſ. $\frac{3}{10}$.

(3) What is the difference between $3\frac{5}{8}$ and $\frac{3}{5}$ of $\frac{5}{8}$?—Anſ. $3\frac{5}{14}$.

(4) What is the difference between $\frac{397}{776}$ and $\frac{1903}{7990}$?—Anſ. $\frac{847651}{3100120}$.

(5) From $115\frac{5}{8}$ take $39\frac{7}{8}$.—Anſ. $75\frac{3}{4}$.

(6) Subtract $\frac{54}{71}\frac{3}{3}$ from an unit—Anſ. $\frac{65}{71}\frac{9}{3}$.

(7) Subtract $\frac{11}{15}$ from 365—Anſ. $364\frac{4}{15}$.

(8) What is the difference between $\frac{2}{3}$ of $\frac{1}{15}$ and $\frac{4}{5}$ of 72?—Anſ. $57\frac{5}{9}$.

(9) To what fraction muſt I add $\frac{3}{5}$ that the ſum may be $\frac{5}{8}$—Anſ. $\frac{1}{40}$.

(10) What number is that to which if $7\frac{2}{3}$ be added the ſum will be $17\frac{3}{5}$?—Anſ. $9\frac{14}{15}$.

(11) What number is that from which if you ſubtract $\frac{1}{11}$ of $\frac{5}{9}$ of an unit, and to the remainder add $\frac{3}{5}$ of $\frac{7}{8}$ of an unit, the ſum will be 9?—Anſ. $8\frac{20831}{39600}$.

(12) What is the difference between $\frac{3}{4}$ of a £ and $\frac{5}{7}$ of a ſhilling?—Anſ. 14s. $3\frac{1}{4}$d. $\frac{5}{7}$.

(13) From $\frac{5}{6}$ of a lb troy take $\frac{5}{8}$ of an ounce.—Anſ. 9 oz $7\frac{1}{2}$dwts.

(14) From $\frac{3}{8}$ of a ton take $\frac{2}{3}$ of $\frac{3}{4}$ of a lb—Anſ. 7cwt 1qr $27\frac{1}{2}$lb.

(15) From $\frac{2}{3}$ of $\frac{3}{5}$ of a hhd of wine take $\frac{3}{5}$ of $\frac{1}{2}$ of a pint.—Anſ. 25gal $1\frac{3}{10}$pts.

(16) From $\frac{3}{5}$ of a league take $\frac{5}{8}$ of a mile—Anſ. $1\frac{7}{40}$ miles.

(17) From $\frac{5}{9}$ of $365\frac{1}{4}$ days take $\frac{3}{7}$ of $\frac{9}{10}$ of an hour.—Anſ. 202d 21hrs 45m $32\frac{3}{7}$ ſec.

(§. 4.) MULTIPLICATION of VULGAR FRACTIONS.

RULE.

Reduce mixed numbers to improper fractions. Then multiply all the numerators together for a new numerator, and all the denominators together for a common denominator, and reduce the new fraction to its loweſt terms.

Note. The work may be abbreviated by ſtriking out ſuch multipliers as are found both in the numerators and denominators.

(1) Multiply $3\frac{5}{8}$, $\frac{31}{88}$ and $\frac{3}{5}$ of $\frac{9}{10}$, together.

First $3\frac{5}{8} = \frac{29}{8}$.

Then $\frac{29}{8} \times \frac{31}{88} \times \frac{3}{5} \times \frac{9}{10} = \frac{24273}{352000}$, product.

(2) Required the product of $\frac{3}{7}$ and $\frac{11}{15}$.—Anſ. $\frac{11}{35}$.

(3) What is the product of 574 by $\frac{37}{84}$?—Anſ. 252 $\frac{5}{6}$.

(11) Di-

(4) Required the product of $17\frac{1}{2}\frac{5}{9}$ by 27.—Anſ. $13\frac{8}{9}$.

(5) Required the product of $7\frac{2}{3}$ by 25.—Anſ. $191\frac{2}{3}$.

(6) What is the product of $\frac{5}{8}$ of $\frac{3}{7}$, $\frac{2}{3}$ of $15\frac{1}{2}$, and $\frac{3}{11}$ of 2?—Anſ. $\frac{465}{308}$.

(7) What is the continual product of $\frac{3}{4}$, $\frac{12}{5}$, and $\frac{42}{13}\frac{45}{14}$.—Anſ. $\frac{7641}{77560}$.

(8) What is the product of $\frac{3}{5}$ of $\frac{7}{11}$ of 15, and $\frac{14}{15}$ of $11\frac{5}{8}$?—Anſ. $62\frac{31}{220}$.

(9) Multiply 7ft 9in by 3ft.11in, and that product by 5ft 3in.—Anſ. $159\frac{23}{64}$ft.

(10) If a board be 12ft 9in long, and 5ft 7in broad, how many ſquare feet does it contain?—Anſ. $71\frac{3}{16}$ft.

(11) If a room be 17ft $9\frac{1}{3}$in round, and 9ft 9in high, how many ſquare feet does it contain?—Anſ. $173\frac{1}{3}$ft.

(§. 5.) DIVISION of VULGAR FRACTIONS.

Rule.

Reduce mixed numbers to improper fractions, and compound fractions to ſimple ones. Then invert the diviſor, and proceed exactly as in Multiplication.

(1) Divide $\frac{3}{8}$ of $5\frac{1}{3}$ by $\frac{189}{418}$.

Firſt $\frac{3}{8}$ of $5\frac{1}{3} = \frac{3}{8}$ of $\frac{16}{3} = \frac{2}{1}$ dividend.

Then $\frac{418}{189} \times \frac{2}{1} = \frac{836}{189} = 4\frac{80}{189}$ anſwer.

(2) Divide $\frac{16}{19}$ by $\frac{3}{4}$.—Anſ. $1\frac{52}{57}$.

(3) Divide $\frac{18}{97}$ by 6.—Anſ. $\frac{3}{97}$.

(4) Divide $\frac{23}{37}$ by 7.—Anſ. $\frac{23}{259}$.

(5) Divide $\frac{36}{73}$ by $\frac{9}{25}$.—Anſ. $1\frac{11}{73}$.

(6) Divide $\frac{2}{11}$ by $\frac{7}{11}$.—Anſ. $\frac{2}{7}$.

(7) Divide $\frac{3}{7}$ of $\frac{5}{9}$ by $\frac{3}{8}$ of $\frac{15}{16}$.—Anſ. $1\frac{28}{135}$.

(8) Divide $15\frac{5}{8}$ by $\frac{7}{8}$ of $\frac{3}{11}$.—Anſ. $65\frac{5}{21}$.

(9) Divide $34\frac{1}{7}$ by $\frac{4763}{8224}$. Anſ. $58\frac{31758}{33341}$.

(10) Divide $\frac{562}{1045}$ by $\frac{568}{1195}$.—Anſ. $1\frac{7803}{59356}$.

(11) Divide $\frac{7}{8}$ of $\frac{3}{5}$ of $5\frac{1}{9}$ by $\frac{3}{2}$ of $\frac{1}{3}$ of 19.—Anſwer $1\frac{47}{114}$.

(12) What number, multiplied by $\frac{3}{4}$, will give $15\frac{3}{4}$ for the product?—Anſ. 21.

(13) Divide $34\frac{3}{7}$ by 84, or reduce * $\frac{34\frac{3}{7}}{84}$ to a ſimple fraction. Anſ. $\frac{243}{588}$.

(14) Divide 44 by $147\frac{3}{5}$, or reduce $\frac{44}{147\frac{3}{5}}$ to a ſimple fraction.—Anſ. $\frac{99}{332}$.

(15) Divide 247 by $\frac{5}{7}$, or reduce $\frac{247}{\frac{5}{7}}$ to a ſimple fraction. Anſ. $\frac{1729}{5}$.

(16) Divide $\frac{147}{514}$ by 1789, or reduce $\frac{\frac{147}{514}}{1789}$ to a ſimple fraction.—Anſ. $\frac{147}{919546}$.

(17) Divide $394\frac{74}{99}$ by $894\frac{547}{719}$, or reduce $\frac{394\frac{74}{99}}{894\frac{547}{719}}$ to a ſimple fraction.—Anſ. $\frac{28098520}{63689967}$.

(§. 6.) The DIRECT RULE of THREE in VULGAR FRACTIONS.

RULE.

State the queſtion as in the Rule of Three in whole numbers. Reduce mixed numbers to improper fractions, and compound fractions to ſimple ones, and the firſt and third terms to the ſame denomination. Then invert the firſt term of the ſtating, and multiply the three terms together, and the product will be the anſwer.

* Examples of this kind are termed by arithmeticians complex fractions. The 13th and following examples comprize all the different forms of complex fractions that can poſſibly occur; and the manner in which I have expreſſed them ſufficiently ſhews the propriety of my inſerting ſuch examples under the title of Diviſion; for every fraction denotes a diviſion of its numerator by the denominator, and its value is equal to the quotient obtained by ſuch a diviſion.

(1) If

(1) If $\frac{5}{8}$ of a yard coſt $\frac{2}{3}$ of a £. what will $\frac{7}{11}$ of an ell Engliſh coſt?

First $\frac{5}{8}$ of a yard $= \frac{5}{8}$ of $\frac{4}{3} = \frac{1}{2}$ of an ell.

Then, if $\frac{1}{2}$ ell : $\frac{2}{3}$£ :: $\frac{7}{11}$ ell.

$\frac{2}{1} \times \frac{2}{3} \times \frac{7}{11} = \frac{28}{33}$£ = 10s. $2\frac{2}{11}$d. anſ.

(2) If $\frac{7}{11}$ of an Engliſh ell coſt 10s. $2\frac{2}{11}$d. what will $\frac{5}{8}$ of a yard coſt?—Anſ. 8s.

(3) If $\frac{3}{5}$ of a lb coſt 7s. 9d. what will $54\frac{5}{8}$lb coſt?—Anſ. 35l. 5s. $6\frac{3}{4}$d. $\frac{1}{2}$.

(4) If $\frac{3}{11}$ of $\frac{5}{8}$ of 15 ells of Holland coſt $2\frac{1}{11}$l. what will $\frac{3}{5}$ of 175 yards coſt at that rate?—Anſ. 68l. 13s. $10\frac{1}{4}$d. $\frac{3}{5}$.

(5) Bought $5\frac{1}{2}$ pieces of ſilk, each containing $35\frac{2}{11}$ ells Engliſh, at 5s. $3\frac{3}{8}$d. per ell, what is the value of the whole quantity?—Anſ. 52l. 0s. $4\frac{3}{4}$d. $\frac{1}{2}$.

(6) Bought $14\frac{5}{11}$ tuns of wine at 3s. $3\frac{5}{8}$d. per qt, how much did I pay for the whole?—Anſ. 2405l. 11s. $11\frac{3}{4}$d. $\frac{2}{11}$.

(7) If $\frac{3}{5}$ of $\frac{7}{9}$ of a yard of cloth coſt $\frac{2}{3}$ of $\frac{5}{8}$ of a £. what will 179 Engliſh ells coſt?—Anſ. 199l. 15s. $6\frac{1}{4}$d. $\frac{5}{7}$.

(8) At $7\frac{3}{4}$d. per lb what will 11 hhds of ſugar amount to, each hhd weighing 4cwt 3qr $15\frac{5}{8}$lb?—Anſ. 194l. 10s. $5\frac{1}{32}$d.

(§. 7.) The RULE of THREE INVERSE in VULGAR FRACTIONS.

Rule.

State the queſtion as in whole numbers. Reduce mixed numbers to improper fractions, and compound fractions to ſimple ones, and the firſt and third terms to the ſame denomination. Then invert the third term of the ſtating, and multiply the three terms together.

(1) If $24\frac{2}{5}$ ſhillings will pay for the carriage of a cwt $137\frac{3}{8}$ miles, how far may $5\frac{3}{8}$ cwt be carried for the ſame money?

First $137\frac{3}{8}$m. $= \frac{1099}{8}$m. and $5\frac{3}{8}$cwt. $= \frac{43}{8}$cwt.

Then, if $\frac{1}{1}$cwt. : $\frac{1099}{8}$m. :: $\frac{43}{8}$cwt.

$\frac{1}{1} \times \frac{1099}{8} \times \frac{8}{43} = \frac{1099}{43}$m. $= 25\frac{24}{43}$m. anſw.

(2) How

(2) How many yards of matting, $\frac{3}{4}$ of a yard wide, will be ſufficient to cover a floor that is $15\frac{1}{2}$ feet broad, and $27\frac{3}{4}$ feet long?—Anſ. 63 $\frac{39}{54}$yds.

(3) How many yards of cloth, at 5s. 8d. per yard may I give for $57\frac{1}{4}$ yards of cloth at 4s. 3d. per yard, that I may loſe nothing?—Anſ. $43\frac{17}{54}$yds.

(4) What quantity of ſhalloon, $\frac{3}{4}$ of a yard wide, will line $11\frac{3}{4}$ yards of cloth, $1\frac{1}{4}$ yard wide?—Anſ. $39\frac{1}{6}$yds.

(5) If I have $3\frac{3}{4}$cwt carried $15\frac{1}{2}$ miles for 4 guineas, how far ought $9\frac{1}{2}$ cwt to be carried for the ſame money?—Anſ. 6 $\frac{9}{76}$ miles.

(§. 8.) The RULE of FIVE in VULGAR FRACTIONS.

RULE.

State the queſtion as in whole numbers. Reduce mixed numbers to improper fractions, and compound fractions to ſimple ones, and the terms in the ſecond line to the ſame denomination as thoſe above them. Then invert the terms, which are to be multiplied together for a diviſor, and take the continual product of all the terms for the anſwer.

(1) If £$3\frac{1}{2}$ be the wages of 13 men for $7\frac{1}{2}$ days, what will be the wages of 20 men for $15\frac{1}{3}$ days?

First $3\frac{1}{2}$£ = $\frac{7}{2}$£. $7\frac{1}{2} = \frac{15}{2}$d. and $15\frac{1}{3}$d. = $\frac{46}{3}$d.

Then, if $\frac{13}{1}$m. : $\frac{15}{2}$d. : $\frac{7}{2}$£.

$\frac{20}{1}$m. : $\frac{46}{3}$d. : *

$$\frac{1}{13} \times \frac{2}{15}; \times \frac{20}{1} \times \frac{46}{3} \times \frac{7}{2} \text{ £} = \frac{1288}{117}\text{£} = 11\frac{1}{117}\text{£}.$$

(2) What is the intereſt of 490l. 15s. for $7\frac{3}{4}$ years, at $4\frac{1}{2}$ per cent per annum?—Anſ. 171l. 2s. $11\frac{1}{2}$d. $\frac{1}{10}$.

(3) If a footman travel 294 miles in $7\frac{3}{5}$ days of $12\frac{1}{2}$ hours long, in how many days, of $10\frac{3}{4}$ hours each, will he travel $147\frac{1}{8}$ miles?—Anſ. 4 $\frac{74663}{150344}$ days.

(4) Bought 5000 deals, of 15 feet long and $2\frac{1}{2}$ inches thick, how many deals are they equivalent to of $12\frac{1}{2}$ feet long and $1\frac{3}{4}$ inch thick?—Anſ. 8571$\frac{3}{7}$ft.

(5) If $13\frac{1}{2}$ ells of cloth, $\frac{3}{5}$ yard wide, coſt $5\frac{1}{2}$ guineas, what will $33\frac{1}{4}$ yards, $\frac{3}{7}$ of an ell Engliſh wide, and of the ſame goodneſs, come to?—Anſ. 15l. 16s. $0\frac{3}{4}$d. $\frac{23}{77}$.

*(6) If

*(6) If 7¾oz of bread be bought for 4¾d. when corn is at 4⅓ ſhillings per buſhel, what weight of it may be bought for 1⅙ ſhillings, when the price of the buſhel is 5½ ſhillings?—Anſ. 1lb 4oz 3$\frac{4}{6}\frac{7}{4}\frac{2}{7}$dwt.

*(7) If 500lb of beef be ſufficient for 125 ſeamen for 3½ days, how much will ſerve 275 ſeamen 31½ days.—Anſ. 990clb.

*(8) If the carriage of 5¼cwt for 150 miles coſt £3$\frac{11}{30}$ how much muſt be paid for the carriage 7$\frac{31}{112}$ cwt for 64 miles, at the ſame rate?—Anſ. 1l. 18s. 7d.

(§. 9.) DECIMAL FRACTIONS.

Definition 1. *Decimal Fractions* are ſuch as have 10, 100, 1000, &c. for their denominator; thus $\frac{1}{10}$, $\frac{25}{100}$, $\frac{225}{1000}$, &c. are decimal fractions; and theſe are expreſſed by writing the numerator only, with a point before it on the left hand; thus ·1, ·25, ·225, &c.

2. *When the Numerator* of a decimal fraction is written without its denominator, it muſt always conſiſt of as many figures as there are ciphers in the denominator, thus $\frac{5}{10}$=·5, $\frac{5}{100}$=·05, $\frac{5}{1000}$=·005, &c. Hence the denominator of a decimal fraction is an unit with as many ciphers as there are figures in the decimal.

3. *Ciphers on the right hand* of decimals make no alteration in their value, thus ·5, ·500, ·5000, &c. are decimals of the ſame value, for $\frac{5}{10}=\frac{500}{1000}=\frac{5000}{10000}=\frac{1}{2}$ by the nature of vulgar fractions.

4. *Ciphers on the left Hand* of decimals decreaſe their value; thus ·5, ·05, ·005, &c.=$\frac{5}{10}$, $\frac{5}{100}$, $\frac{5}{1000}$, &c.

5. *A mixed Number* is compoſed of a whole number and a decimal, which are ſeparated from each other by a point, thus 115·5 ſignifies 115$\frac{5}{10}$.

(§. 10.) ADDITION of DECIMALS.

RULE.

Place all the decimal points directly under each other, ſo that tenths may ſtand under tenths, and hundredth parts under hundredth parts, &c. in the decimals; and tens under tens, hundreds under hundreds, &c. in the whole numbers. Then add them together as in whole numbers, and from the right hand

hand of the ſum point off as many figures, for decimals, as are equal to the greateſt number of decimals in any of the given numbers.

(1.) Add 5·74+3·75+94·375+·745+·005495 together

5·74
3 75
94·375
·745
·005495

104·615495 ſum.

(2) Add 5·714+3·456+·543+17·4957 together
(3) Add 3·754+47·5+·00857+37·5 together
(4) Add 54·34+·375+14·795+1·5 together
(5) Add 71·25+1·749+1759·5+3·1 together
(6) Add 375·94+5·732+14·375+1·5 together
(7) Add ·005+·0057+31·008+·00594 together

(§. 11.) SUBTRACTION of DECIMALS.

RULE.

Place the leſs number under the greater, the points under the points, tenths under tenths, hundredth parts under hundredth parts, &c. in the decimals; and the whole numbers under thoſe of the ſame denomination. Then ſubtract as in whole numbers, placing the ſeparating point, in the remainder, directly under thoſe above it.

(1) From 57·439 take 5·93754.

57·439
5 93754

51·50146 difference.

(2) Required the difference between 57·49 and 5·768.—Anſ. 51·722.

(3) What is the difference between ·3054 and 3·075?—Anſ. 2·7696.

(4) Required the difference between 1745·3 and 173·45.—Anſ. 1571·85.

(5) What is the difference between ſeven-tenths of an unit and 54 ten thouſandth parts of an unit?—Anſ. ·6946.

(6) What

(6) What is the difference between ·105 and 1·00075?—Anſ. ·89575.

(7) What is the difference between 150·43 and 754·355?—Anſ. 603·925.

(8) From 1754·754 take 375·49478.—Anſ. 1379·25922.

(9) Take 75·304 from 175·01.—Anſ. 99·706.

(10) Required the difference between 17·541 and 35·49.—Anſ. 17·949.

(§. 12.) MULTIPLICATION of DECIMALS.

RULE.

Multiply the decimals as if they were whole numbers, and from the product cut off as many decimal places as there are in both the multiplier and multiplicand. If there are not ſo many places in the product, ſupply the defect by prefixing ciphers to the left hand.

Note 1. When any decimal is to be multiplied by 10, 100, 1000, &c. remove the ſeparating point as many places to the right hand as there are ciphers; thus, ·543×10=5·43; alſo ·7156×1000=715·6, &c.

Ex. 1. Multiply 4·735
By ·374

18940
33145
14205

1·770890 prod.

Ex. 2. Multiply ·004735
By ·0374

18940
33145
14205

·0001770890 prod.

(3) Multiply 473·54 by ·057
(4) Multiply 137·549 by 75·437
(5) Multiply 3·7495 by ·73487
(6) Multiply ·04375 by ·47134
(7) Multiply ·371343 by ·75493
(8) Multiply 49·0754 by 3·5714
(9) Multiply ·573005 by ·000754
(10) Multiply ·375494 by 574·375

Contracted Multiplication of Decimals.

RULE.

Put the unit's place of the multiplier under that place of the multiplicand which you intend to keep in the product, and

and invert the order of all the other figures, that is, write the decimals on the left hand, and the integers, if any, on the right. In multiplying, always begin with that figure of the multiplicand which ſtands directly over the multiplying digit, and ſet the firſt figure in every product in a right line under each other to the right hand, obſerving to increaſe the firſt figure of every line with what would ariſe, by carrying 1 from 5 to 15, 2 from 15 to 25, 3 from 25 to 35, &c. from the product of the two figures (in the multiplicand) on the right hand of the multiplying digit.

(1) Multiply 2·38645 by 8·2175, and let there be only four places of decimals retained in the product.

Contracted way.		Common way.	
2 38645		2·38645	
5712·8		8·2175	
190916		11 93225	
4773		167 0515	
239		238 645	
167		4772 90	
12		190916 0	
19·6107		19·6106	52875

(2) Let 54·7494367 be multiplied by 4·724753, reſerving only five places of decimals in the product.—Anſ. 258·67756.

(3) Multiply 475·710564 by ·3416494, retaining three decimals in the product.—Anſ. 162·525.

(4) Multiply 3754·4078 by ·7·4576, retaining five decimals in the product.—Anſ. 2757·89786.

(5) Let 4745.679 be multiplied by 751.4549, and reſerve only the integers in the product.—Anſ. 3566163.

(§. 13.) DIVISION of DECIMALS.

RULE.

Divide as in whole numbers, and from the right hand of the quotient point off as many figures for decimals as the decimal places in the dividend exceed thoſe in the diviſor; but, if the quotient does not contain ſuch a number of figures as is equal to the exceſs, the defect muſt be ſupplied with ciphers to the left hand. If the number of decimal places in the diviſor ſhould be more than thoſe in the dividend, annex as many

many ciphers to the dividend as will make them equal, and the quotient will be integers till all these ciphers are used; after which, you may continue the quotient to any assigned degree of exactness, by subjoining a cipher continually to the last remainder.

Note 1. To divide by 10, 100, 1000, &c. remove the separating point as many places to the left hand as there are ciphers; thus, ·543÷10=·0543, and 715·6÷1000=·7156, &c.

(Ex. 1.) Divide ·475321 by ·97453.

```
97·453)·47532100000(·0048774
       855090
        754660
         724890
          427190
          ------
          37378 rem.
```

(Ex. 2.) Divide 475·321 by ·97453.

```
·97453)475·3210000(487·74, &c.
       855090
        754660
         724890
          427190
          ------
          37378, &c.
```

(3) Divide 17·543275 by 125·7
(4) Divide 143754·35 by ·7493
(5) Divide ·000177089 by ·0374
(6) Divide 16 by 960
(7) Divide 12 by 1728
(8) Divide 47·5493 by 34·75
(9) Divide 74·3571 by ·00573
(10) Divide ·3754 by 75·714

Contracted Division of Decimals.

RULE.

In Division, the first figure in the quotient must always possess the same place with that figure of the dividend under which the unit's place of its product stands. Having thus determined the value of the quotient figures, make use of as many figures in the divisor, reckoning from the left hand towards the right, as you intend to have in the quotient. Let each remainder be a new dividend, and, for every such new dividend, leave out one figure to the right hand of the divisor, observing to carry for the increase of the figures cut off, as in contracted Multiplication.

Note. When there are not so many figures in the divisor as are required to be in the quotient, begin the division with all the figures, as usual, and continue it till the number of figures in the divisor is equal to the number of figures remaining to be found in the quotient, after which use the contraction.

(1) Divide 754·347385 by 61·34775, and let the quotient contain only three places of decimals.

Contracted way.	Common way.
61·34775)754·347385(12·296	61·34775)754·347385000(12·296
14086	14086|988
1817	1817|4385
590	590|48350
38	38|353750
1	1|545100

(2) Divide 59 by ·74571345, and let the quotient contain four places of decimals.—Anſ. 79·1188.

(3) Divide 17493·407704962 by 495·783269, and let the quotient contain four places of decimals.—Anſ. 35·2843.

(4) Divide 98·187437 by 8·4765618, and let the quotient contain ten places of decimals.—Anſ. 11·5834036625.

(5) Divide 47194·379457 by 14·73495, and let the quotient contain as many decimal places as there will be integers in it.—Anſ. 3202·8869.

(§. 14.) REDUCTION of DECIMALS.

PROPOSITION I.

To reduce a vulgar Fraction to a Decimal of equal Value.

RULE.

Annex ciphers to the numerator till it be equal to, or greater than, the denominator: then divide by the denominator as in Diviſion of Decimals, and the quotient will be the anſwer.

(1) Reduce $\frac{7}{8}$ to a decimal.

8) 7·000 (·875 anſwer.
60
40

(2) Reduce $\frac{4}{7}$ to a decimal.—Anſ. ·571428, rem 4.

(3) Reduce $\frac{1}{1\frac{1}{43}}$ to a decimal.—Anſ. ·00411522 63—91.

(4) Reduce $\frac{3}{4}$ to a decimal.—Anſ. ·75.

(5) Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{5}{8}$ to a decimal.—Anſ. ·20833, &c.—8.

(6) Reduce $15\frac{5}{163}$ to a mixed decimal.—Anſ. 15·38461—7.

(7) Reduce $\frac{5}{29}$ to a decimal.—Anſ. ·17241379—9.

(8) Reduce $1\frac{5}{191}$ to a decimal.—Anſ. ·026178010471—79.

PRO-

Proposition II.

*To reduce Numbers of different Denominations, as Coins, Weights, Measures, &c. into Decimals.**

Rule I. Reduce the given money, weight, &c. into the loweſt denomination mentioned for a dividend; then reduce the integer into the ſame denomination for a diviſor; the quotient produced by this diviſion will be the decimal required.

Rule II. Write the given denominations, or parts, regularly under each other, proceeding from the loweſt denomination to the higheſt; let theſe be the dividends. Oppoſite to each dividend, on the left hand, place ſuch a number for a diviſor as will reduce it to the next ſuperior name, and draw a line between them. Begin to divide with the uppermoſt numbers, and write the quotients of each, as decimal parts, on the right hand of the dividend next below it. Divide this mixt number by its diviſor, and ſo on till they are all uſed, the laſt quotient will be the decimal required.

(9) Reduce 18s. 9¾d. to the decimal of a pound.

By rule 1.			By dec. Tables.			By rule 2.		
£.	s.	d.	s.	d.		4	3	farthings.
20	18	9¾	0	0¾ =	·003125	12	9	·75 pence.
12	12		0	6 =	·025	20	18	·8125 ſhillings.
240	225		0	3 =	·0125			·940625 £.
4	4		18	0 =	·95			
960)	903·000000 (	·940625	18	9¾ =	·940625			

(10) Reduce 7s. 5½d. to the decimal of a pound.—Anſ. ·37291666, &c. £.

(11) What decimal part of a pound is three-halfpence?—Anſ. ·00625l.

(12) Reduce 4s. 7 9/11d. to the decimal of a pound.—Anſ. ·2325757, &c. £.

(13) Reduce 1oz 11dwt 3gr to the decimal of a pound troy.—Anſ. ·129687 5lb.

(14) Reduce 24 grains to the decimal of an ounce troy.—Anſ. ·05oz.

* The decimal tables of coin, weights, meaſures, &c. are calculated by one or other of the rules given to this propoſition, thus in table I. 19s = ·95l. &c. The uſe of theſe tables is exemplified in the 9th example.

(15) Reduce 5oz 4dr avoirdupois to the decimal of a pound troy.—Anſ. ·39873453lb. troy.

(16) Reduce 3cwt 1qr 14lb to the decimal of a ton.—Anſ. ·16875.

(17) Reduce 2qr 15lb to the decimal of a hundred weight.—Anſ. ·6339285714cwt.

(18) Reduce 5lb 10oz 3dwt 13gr troy to the decimal of a hundred weight avoirdupois.—Anſ. ·04296863cwt.

(19) Reduce 1qr 1 nail to the decimal of a yard.—Anſ. ·3125 yds.

(20) Reduce 2qr 3n to the decimal of an Engliſh ell.—Anſ. ·55 ells Engliſh.

(21) Reduce 14yds 2ft 6½in. to the decimal of a mile.—Anſ. ·0084359217 mile.

(22) What decimal part of an acre is 1r. 37poles?—Anſ. ·48125acres.

(23) What decimal part of a hogſhead of wine is 2qts 1 pint?—Anſ. ·009920634 9hhd.

(24) Reduce 3buſh. 3pecks to the decimal of a chaldron of 32 buſhels.—Anſ. ·1171875ch.

(25) What decimal part of a year is 3w. 4d. 5hrs. reckoning 365d 6hrs a year?—Anſ. 0747205 1165hrs.

(26) Reduce 2·45 ſhillings to the decimal of a £.—Anſ. ·1225

(27) Reduce 1·074 roods to the decimal of an acre.—Anſ. ·2685acres.

(28) Reduce 17·69 yards to the decimal of a mile.—Anſ. ·10005 1136 mile.

PROPOSITION III.

To find the Value of any decimal Fraction in the known Parts of an Integer.

RULE.

Multiply the given decimal by the number of parts contained in the next inferior denomination; and, from the right hand of the product, point off as many figures as the given decimal conſiſts of. Multiply the remaining decimals by the parts in the next inferior denomination, and from what reſults cut off as before. Proceed thus till you have brought out the leaſt known parts of the integer, and then the ſeveral denominations, on the left hand of the decimal points, will expreſs the value of the decimal.

(29) Re-

(29) Required the value of ·03125 of a pound ſterling.

·03125
20
s. 0·62500
12
d. 7·50000
4
qrs. 2·00000 Anſ. 7½d.

(30) What is the value of ·7575 of a pound ſterling?—Anſ. 15s. 1¾d. ·2.

(31) Required the value of ·75435 of a ſhilling.—Anſ. 9·0522d.

(32) What is the value of ·375 of a guinea?—Anſ. 7s. 10½d.

(33) What is the value of ·4575 of a hundred weight?—Anſ. 1qr 23lb 3oz 13·44drs.

(34) What is the value of ·175 of a ton avoirdupois?—Anſ. 3cwt 2qrs.

(35) What is the value of ·05875 of a pound avoirdupois?—Anſ. 15·04drs.

(36) Required the value of ·02575 of a pound troy.—Anſ. 6dwt. 4·32g.

(37) Required the value of ·075 of a yard.—Anſ. 1·2na.

(38) Required the value of ·475 of an Engliſh ell.—Anſ. 2qr. 1·5n.

(39) What is the value of ·04535 of a mile?—Anſ. 14p 2yds 2ft 5in 1·128b. c.

(40) What is the value of ·6375 of an acre?—Anſ. 2r 22p.

(41) What is the value of ·574 of a hogſhead of beer?—Anſ. 30gal 3qt 1·968pt.

(42) What is the value of ·4285 of a year?—Anſ. 156d. 12hrs 13m 51ſec 36thirds.

(43) Required the ſum of ·475 of a pound and ·375 of a ſhilling.—Anſ. 9s. 10½d.

(44) Required the ſum of ·573 of an inch and ·751 of a yard.—Anſ. 2ft 3in 1 827b. c.

(45) Required the difference between ·5 of a mile and ·375 of a furlong.—Anſ. 3f 25p.

(46) Required the difference between ·625 of a cwt. and ·20835 of a ton.—Anſ. 4cwt 3qr 4lb 11oz 4·224drs.

(47) Required the ſum of ·175 ton, ·195 cwt 145qr and ·15lb.—Anſ. 3cwt 2qr 26lb 12·8drs.

(48) Required the ſum of ·575lb troy and 845oz.—Anſ. 70z 14dwt 21·6grs.

* Decimal Tables of Coin, Weight, and Measure.

TABLE I.

English Coin.
1 £ the Integer.

Sh.	dec.	Sh.	dec.
19	·95	9	·45
18	·9	8	·4
17	·85	7	·35
16	·8	6	·3
15	·75	5	·25
14	·7	4	·2
13	·65	3	·15
12	·6	2	·1
11	·55	1	·05
10	·5		

Pence.	Decimals.
6	·025
5	·020833
4	·016666
3	0125
2	·008333
1	·004166

Farthings.	Decimals.
3	·003125
2	·0020833
1	·0010416

TABLE II.

Eng. Coin. 1 *Sh.*
Long Meas. 1 Foot the Integer.

Pence and Inches	Decimals.
6	·5
5	·416666
4	·333333
3	·25
2	·166666
1	·083333

Farthings.	Decimals.
3	·0625
2	·041666
1	·020833

TABLE III.

Troy Weight.
1lb the Integer.
Ounces the same as Pence in the last Table.

Penny-weight.	Decimals.
10	·041666
9	·0375
8	·033333
7	·029166
6	·025
5	·020833
4	·016666
3	·0125
2	·008333
1	·004166

Grains.	Decimals.
12	·002083
11	·001910
10	·001736
9	·001562
8	·001389
7	·001215
6	·001042
5	·000868
4	·000694
3	·000521
2	·000347
1	·000173

1 Oz. the Integer.
Penny-weights the same as Shillings in the first Table.

Grs.	Decimals.
12	·025
11	·022916
10	·020833
9	·01875
8	·016666
7	·014583
6	·0125
5	·010416
4	·008333
3	·00625
2	·004166
1	·002083

TABLE IV.

Avoirdup Wt
1 12lb the Integer

Qrs.	Decimals.
3	·75
2	·5
1	·25

Pnds	Decimals.
14	·125
13	·116071
12	·107143
11	·098214
10	·089286
9	·080357
8	·971428
7	·0625
6	·053571
5	·044643
4	·035714
3	·026786
2	·017857
1	·008928

Oun.	Decimals.
8	·004464
7	·003906

Decimal Tables of Weight, and Measure.

6	·005348
5	·002790
4	·002232
3	·001674
2	·001116
1	·000558

¼ Oz.	Decimals
3	·000418
2	·000279
1	·000139

TABLE V.

AVOIRDUPWT
1lb. the Integer.

Oun	Decimals
8	·5
7	·4375
6	·3 5
5	·3125
4	·25
3	·1875
2	·125
1	·0625

Drams.	Decimals
8	·03215
7	·027343
6	·023437
5	·019531
4	·015625
3	·011718
2	·007812
1	·003906

TABLE VI.

LIQUID MEAS.
1 Tun the Integer

Gallons	Decimals
100	·399825
90	·357141
80	·317460
70	·27
60	·238095
50	·198412
40	·158730
30	·119047
20	·079365
10	·039682
9	·035714
8	·031746
7	·027
6	·023809
5	·019841
4	·015873
3	·011904
2	·007936
1	·003968

Pints.	Decimals
4	·001984
3	·001488
2	·000992
1	·000496

A Hogshead the Integer.

Gallons.	Decimals
30	·476190
20	·317460
10	·158730
9	·142857
8	·126984
7	·111111
6	·095238
5	·079365
4	·063492
3	·047619
2	·031746
1	·015873

Pints.	Decimals
3	·005952
2	·003968
1	·001984

TABLE VII.

MEASURE.
Liquid Dry.
1 Gallon, 1 Quar.
Integer.

Pint.	Dec.	Bush.
4	·5	4
3	·375	3
2	·25	2
1	·125	1

Q. pt.	Decim.	Pk.
3	·09375	3
2	·0625	2
1	·03125	0

Decimals.	Q. Pks
·0234375	3
·015625	2
·0078125	1

Decimals.	Pints.
·005859	3
·003906	2
·001953	1

TABLE VIII.

LONG MEASURE
1 Mile the Integer

Yards.	Decimals.
1000	·568182
900	·511364
800	·454545
700	·397727
600	·340909

* Decimal TABLES *of* COIN, WEIGHT, *and* MEASURE.

500	·284091
400	·227272
300	·170454
200	·113636
100	·056818
90	·051136
80	·045454
70	·039773
60	·034091
50	·028409
40	·022727
30	·017045
20	·011364
10	·005682
9	·005114
8	·004545
7	·003977
6	·003409
5	·002841
4	·002273
3	·001704
2	·001136
1	·000568

Feet.	*Decimals.*
2	·0003787
1	·0001894

Inches.	*Decimals*
6	·0000947
3	·0000474
1	·0000158

TABLE IX.

TIME.

1 Year the Integer.

Months the same as Pence, in the second Table.

Days.	*Decimals.*
365	1 000000
300	·821918
200	·547945
100	·273973
90	·246575
80	·219178
70	·191781
60	·164383
50	·136989
40	·109589
30	·082192
20	·054794
10	·027397
9	·024657
8	·021918
7	·019178
6	·016438
5	·013698
4	·010959
3	008219
2	·006479
1	·002739

1 Day the Integer.

Hours.	*Decimals*
12	·5
11	·458333
10	·416666
9	·375
8	·333333
7	·291666
6	·25
5	·208333
4	·166666
3	·125
2	·083333
1	·041666

Minutes.	*Decimals*
30	·020833
20	·013888
10	·006944
9	·00625
8	·005555
7	·004861
6	·004166
5	·003472
4	·002777
3	·002083
2	·001388
1	·000694

TABLE X.

CLOTH MEASURE.

1 Yard the Integer.

Qrs. the same as Table 4.

Nails.	*Decimals.*
2	·125
1	·0625

TABLE XI.

LEAD WEIGHT.

A Fother the Inte.

Hund.	*Decimals.*
10	·512820
9	·461538
8	·410256
7	·358974
6	·307692
5	·256410
4	·205128
3	·153846
2	·102564
1	·051282

Qrs.	*Decimals.*
2	·025641
1	·012820

Pounds.	*Decimals.*
14	·0064102
13	·0059523
12	·0054945
11	·0050366
10	·0045787
9	·0041208
8	·0036630
7	·0032051
6	·0027472
5	·0022893
4	·0018315
3	·0013736
2	·0009157
1	·0004578

(§. 15.) The RULES of PROPORTION.

Note. The examples following are promiſcuouſly placed to exerciſe the ſcholar in the Rule of Three Direct, Inverſe, and the Rule of Five. As Decimals have the ſame properties as whole numbers, the only difficulty being in pointing off the decimals, it would be ſuperfluous to inſert the rules which have been already given at § 13, 14, and 15, Part I.

*(1) If 3·75 yards of cloth coſt 8s. 9d. what will 257½ yards coſt?

Firſt 8s. 9d. = ·4375 and 257½ yds = 257·5.

yds.	£.	yds.
If 3·75 :	·4375 ::	257·5
	257 5	

£. £. s. d.

3·75)112·65625(30·04166, &c. = 30 0 10 anſwer.

*(2) If ½ cwt of tobacco coſt 4l. 18s. how much may I buy at the ſame rate for ·7l.—Anſ. 8lb.

*(3) Bought 3·5 yards of cloth for 2l. 14s. 3d. what muſt I give for 27·75yds.—Anſ. 21l. 10s. 1¼d.

*(4) Sold 75¾ chaldron of lime, at 11s. 6½ per chaldron, what is the amount?—Anſ. 43l. 14s. 3¾d. ·5

*(5) A goldſmith ſold a tankard for 10·6l. at the rate of 5s. 6d. per oz; what did it weigh?—Anſ. 38oz 10dwt 21·81 grains.

*(6) If 12 men can perform a piece of work in 100⅜ days, in how many days would 20 men perform the ſame?—Anſ. 60·225 days.

*(7) In 754½½⅛ ducats, at 4s. 4d. each, how many dollars at 4s. 5¾d. each?—Anſ. 730 dollars.

*(8) If 5400 bricks be required to pave a yard, when the bricks are ·5 foot long and ·25 broad, how many will be required of ·75 feet long and ⅓ foot broad?—Anſ. 2700 bricks.

*(9) If I buy 14 yards of cloth for 10 guineas, how many ells Flemiſh can I buy for 283·875l?—Anſ 504 ells, 2qr.

*(10) If 1¾ oz of plate coſt 10s. 11¼d. what will a ſervice, weighing 327·61875 oz coſt?—Anſ. 102l. 7s. 7½d.

*(11) How many yards of ell wide flannel is ſufficient to line a cloak, containing 18⅞ yards of cloth ¾ yard wide?—Anſ. 11yds 1qr 1½n.

*(12) If 248 men in 60½ hours dig a trench, containing 13924½ ſolid yards of earth, how many men in 1188 hours, will dig a ſimilar trench, containing 26460 ſolid yards of earth; the earth being caſt at the ſame diſtance from thoſe men as the former?—Anſ. 24 men.

*(13) If

*(13) If 2 men can do 125 rods of ditching, in 65 days, in how many days can 18 men do 242 $\frac{4}{13}$ rods.—Anſ. 14 days.

*(14) If $\frac{3}{4}$ of $\frac{3}{4}$ of a ſhip be worth 147l. 11s. 3d. what is the whole worth?—Anſ. 491l. 17s. 6d.

*(15) If a piece of arras hanging be $6\frac{1}{4}$ yards long, and 4 yards broad, how many ſquare ells Flemiſh are contained therein?—Anſ. 44·444, &c.

*(16) If a wedge of gold, weighing $17\frac{3}{4}$lb troy, be worth $679\frac{5}{7}$l, what is the value of $1\frac{1}{13}$ grain of that gold?—Anſ. 2d.

*(17) What will be the expence of tiling an out-houſe that is 273·5 feet long, and 21·75 feet broad, with tiles at 11s. $10\frac{3}{4}$d. per thouſand, ſuppoſing every ſquare of tiling to take up 1000 tiles?—Anſ. 35l. 7s. $7\frac{1}{2}$d. 64875.

*(18) A man, with his family conſiſting of 4 perſons, uſually drink 7·8 gallons of beer in a week, how much would they drink in 22·5 weeks, if the family were to be increaſed by three perſons?—Anſ. 280·8 gallons.

*(19) I agreed for the carriage of 2·5 tons of goods 2·9 miles, for ·075 guinea, what is that per cwt for a mile?—Anſ. ·521379 $\frac{9}{29}$ farthings.

*(20) If a traveller performs a journey in 35·5 days, when the days are 13·625 hours long; in how many days of 11·9 hours long would he perform the ſame journey?—Anſ. $40·646_{\frac{1}{13}}$.

(§. 16.) INVOLUTION.

Definition 1. *When any given number* is multiplied by itſelf, and that product by the ſame number, and ſo on to any aſſigned number of products, the proceſs is called *Involution*, or the involving a number to any aſſigned power.

2. The given number is called the root, or firſt power; the firſt power multiplied by itſelf gives the ſecond power, or ſquare; the ſecond power multiplied by the firſt gives the third power, or cube; the third power multiplied by the firſt, gives the fourth power, or biquadrate, &c. This definition contains a general rule for involving numbers to any power.

3. *The number denoting the power* is called the *Index*, or *Exponent*, of that power. Thus, if a number is to be involved to the fourth power, then 4 is the index of the power.

4. *Powers*

4. *Powers are generally denoted* by writing the exponent over the first. Thus the ſquare of 205 is written $\overline{205}^{2}$, the cube $\overline{305}^{3}$; alſo the fourth power of $705 \times 9{\cdot}15$ may be expreſſed thus, $\overline{705 \times 9{\cdot}15}^{4}$, &c.

* A TABLE OF POWERS.

	Square or ſecond power.	Cube or third power.	Biquadrate, or ſquare ſquared, or 4th power.	Surſolid, or the fifth power.	Cube ſquared, or the ſquare cubed, or the ſixth power	Second ſurſolid, or ſeventh power.	Biquadrate ſquared, or the eighth power.	Cube cubed, or the ninth power.
	Index.	Index.	Index.	Index.	Index.	Index.	Index.	Index.
	2	3	4	5	6	7	8	9
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

(1) Involve 1·05 to the 9th power

$1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 \times 1{\cdot}05 =$ 1·551328215978515625, the power required. See the ſecond definition.

(2) Square 1754—Anſ. 3076516
(3) Square 549—Anſ. 301401
(4) Cube 3·1416—Anſ. 31·006494199296
(5) Cube ·7854—Anſ. ·484476471864
(6) Involve 57·5 to the 4th power—Anſ. 10931289·0625
(7) Involve 1·732 to the 5th power
Anſ. 15·586171061650432

(8) What

(8) What is the 9th power of 735?
Anſ. 626016891556081399746093 75.

(9) Involve 365 to the 6th power?
Anſ. 2364597285765625.

*(10) Square $\frac{5}{9}$.—Anſ. $\frac{25}{81}$.

*(11) Cube $\frac{3}{4}$.—Anſ. $\frac{27}{64}$.

*(12) Involve $3\frac{1}{3}$ to the fourth power.— Anſ. $\frac{10000}{81}$.

(§. 17.) EVOLUTION.

Definition 1. *The Method of finding* the firſt power, or root, by having the *ſecond*, *third*, &c. power given, is called *Evolution*, or the extraction of roots, and is exactly the reverſe of Involution. Though, in Involution, there is no number whereof we cannot find the exact power, yet, in Evolution, there are many numbers of which we cannot find the preciſe root.

2. *The Roots which are perfectly accurate* are called *rational Roots*, and thoſe roots, which are continually approximating nearer to the truth, yet never arrive at it, are called *ſurd Roots*.

3. *Roots are ſometimes denoted* by writing the character $\surd$ before the power, with the index of the root in it. Thus the ſquare-root of 21 may be expreſſed by $\surd 21$, and the cube-root of 24+7 by $\sqrt[3]{24+7}$.

(§. 18.) SQUARE-ROOT.

Definition. The extraction of the ſquare-root is by having a number given, to find out another number, which being multiplied by itſelf, produces *that* given number.

PROPOSITION I.

To extract the Square-root of any whole Number, or a pure or mixed Decimal.

Rule 1. Put a point over the unit's place, and alſo upon every ſecond figure, from the right hand to the left, in whole numbers, and from the left hand to the right in decimals.

2. Find a ſquare number equal to, or the next leſs than, the left-hand period, and put the root thereof in the quotient; ſubtract

ſubtract this ſquare from the left-hand period, and to the remainder bring down the next period for a dividend

(3) Double the quotient for a diviſor, then conſider what figure muſt be annexed to the right hand thereof, ſo that, if the reſult be multiplied by that figure, the product may be equal to, or the neareſt leſs number than, the dividend, and it will be the ſecond figure in the root. Then bring down the next period, double the figures in the quotient for a diviſor, and proceed in all reſpects as above till you have finiſhed the operation.

For the Proof. Square the root found, and to that product add the remainder, if any; and that ſum will be the ſame as the number given to be extracted.

Squares	1	4	9	16	25	36	49	64	81
Roots	1	2	3	4	5	6	7	8	9

Hence we may obſerve, that, if any number end with 2, 3, 7, or 8, the ſquare-root of that number can never be exactly found.

(1) Extract the ſquare root of 1340095640625.

```
. . . . . .
1340095640625 ( 1157625, the root.
1
---
21) 34
    21
   ---
225) 1300
     1125
    ----
2307) 17595
      16149
     -----
23146) 144664
       138876
      ------
231522) 578806
        463044
       -------
2315245)11476225
        11476225
       --------
```

(2) Extract the ſquare root of 5678·243

(3) What is the ſquare root of 393129?—Anſ. 627

(4) Extract the ſquare root of 3272869681.—Anſ. 57209

(5) Extract the ſquare root of 15241578750190521.—Anſ. 123456789.

(6) Required the ſquare root of 57132.—Anſ. 239·023, remainder 5471.

(7) What is the ſquare root of 75·347?—Anſ. 8·6802649729, &c.

(8) Required the ſquare root of 1788·57777777—Anſ. 42·2915, rem. 680552

(9) What is the ſquare root of ·4325?—Anſ. 65764, rem. 96304

(10) Required the ſquare root of 5·33333333—Anſ. 2·3094, rem. 497.

PROPOSITION II.

To extract the Square-root of any vulgar Fraction.

Rule 1. Reduce the given fraction to its loweſt terms, then extract the ſquare-root of the numerator for a new numerator, and the ſquare-root of the denominator for a new denominator.

2. If the fraction will not extract even, reduce it to a decimal, and then extract the ſquare root.

3. When the number to be extracted is a mixed fraction, reduce the fractional part to a decimal, and annex it to the whole number, then extract the ſquare-root.

(11) What is the ſquare root of $\frac{2025}{2116}$.

The ſquare root of 2025=45, and the ſquare root of 2116=46, hence $\frac{45}{46}$ is the root.

(12) Extract the ſquare root of $\frac{7}{9}$.

$\frac{7}{9}$=·777777777777, the ſquare root of which is ·881917.

(13) What is the ſquare root of $\frac{448}{567}$?—Anſ $\frac{8}{9}$.

(14) Required the ſquare root of $\frac{2750}{5390}$?—Anſ. $\frac{5}{7}$.

(15) Required the ſquare root of $\frac{43}{64}$?—Anſ. 6918984.

(16) What is the ſquare root of $15\frac{5}{8}$?—Anſ. 3·95284.

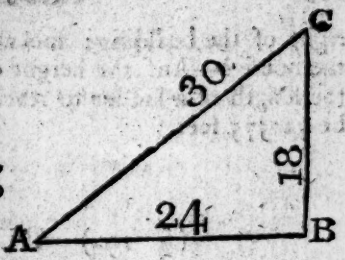
(17) Required the ſquare root of $29\frac{4}{25}$?—Anſ. 5·4

*PROPOSITION III.

Given the baſe and perpendicular of a right-angled Triangle, to find the Hypothenuſe.

Rule. To the ſquare of the baſe add the ſquare of the perpendicular, the ſquare root of the ſum gives the hypothenuſe.

*(18) Given



*(18) Given the baſe AB=24, the perpendicular BC=18; to find the hypothenuſe AC.

24×24=576 the ſquare of the baſe.
18×18=324 the ſquare of the perpendicular.

Sum 900 the ſquare root of which is 30=AC the hypothenuſe.

*(19) The wall of a fort ſtanding on the brink of a river is 42·426 feet high, the breadth of the river is 23 yards; what length muſt a cord be, to reach from the top of the fort acroſs the river?—Anſ. 27 yards.

*PROPOSITION IV.

Given the Hypothenuſe, or longeſt ſide of a right-angled Triangle and either of the other ſides; to find the third ſide.

Rule. Multiply the ſum of the two given ſides by their difference, and extract the ſquare root of the product.

*(20) Given the hypothenuſe=30, and the baſe=24; to find the perpendicular.

30+24=54 ſum of the ſides
30—24= 6 the difference of the ſides
Then 54× 6=324, the ſquare-root of which is 18 anſwer.

(21) A ladder, 50 feet long, will reach to a window 30 feet from the ground on one ſide of the ſtreet; and without moving the foot will reach a window 40 feet high on the other ſide. The breadth of the ſtreet is required.—Anſ. 23⅓ yards.

*(22) A line of 380 feet will reach from the top of a precipice that ſtands cloſe by the ſide of a brook, to the oppoſite bank, and the precipice is 128 feet high; how broad is the brook?—Anſ. 357·79 feet.

*(23) If a ladder of 50 feet in length exactly reach the coping of a houſe, when the foot is 10 feet from the upright of the building, how long muſt a ladder be to reach the bottom of the ſecond floor window, which is 17·9897 feet from the coping, the foot of the ladder ſtanding 6 feet from the up-

right of the building; and what is the height of the wall of the houſe?—Anſ. the height of the wall is 48·9897 feet, and the length of a ladder to reach the ſecond floor window muſt be 31·575 feet.

(§. 19.) CUBE-ROOT.

Definition. The extraction of the cube-root is, by having a number given, to find out another number, which being firſt multiplied by itſelf, and then into that product, produces the given number.

PROPOSITION I.

To extract the Cube-root of any whole Number, or a pure or mixed Decimal.

Rule 1. Put a point over the unit's place, and alſo upon every third figure from the right hand to the left, in whole numbers, and from the left hand to the right in decimals.

2. Find the neareſt leſs cube to the left-hand period, and ſubtract it therefrom: put the root in the quotient, and bring down the figures in the next period for a *Reſolvend*.

3. Find a diviſor by multiplying the ſquare of the quotient by 300, ſeek how often it is contained in the *Reſolvend*, and put the anſwer in the quotient.

4. Cube the laſt figure in the quotient, multiply all the figures in the quotient by 30, except the laſt, and that product by the ſquare of the laſt; laſtly, multiply the diviſor by the laſt figure, and the ſum of theſe products will give the *Subtrahend*, which take from the *Reſolvend*; to the remainder bring down the next period, and repeat the work.

For the Proof. Cube the root found, and to the product add the remainder, if any, and that ſum will be the ſame as the number given to be extracted.

Cubes	1	8	27	64	125	216	343	512	729.
Roots	1	2	3	4	5	6	7	8	9.

(1) Extract

(1) Extract the cube root of 48627·125.

48627·125(36·5 root.
3 cubed=27

3 squared × 300=2700)21627 resolvend.

6 cubed = 216
3 × 30 × 6 squared = 3240
Divisor 2700 × last figure 6 = 16200

19656 subtrahend

36 squared × 300=388800)1971125 resolvend.

5 cubed = 125
36 × 30 × 5 squared = 27000
Divisor 388800 × last figure 5 = 1944000

1971125 subtrahend.

(2) Required the cube root of 122615327232.—Anſ. 4968.

(3) Required the cube root of 41421736—Anſ. 346

(4) Extract the cube root of 705·919947284—Anſ. 8·904 rem. 20.

(5) Required the cube root of 17·54—Anſ. 2·598—4528808.

(6) What is the cube root of 254358061056000?—Anſ. 63360.

(7) The cube root of ·57345 is required—Anſ. 8308—8045888.

(8) Extract the cube root of 75·3857 — Anſ. 4·224—20348576.

(9) What is the cube root of ·7854?—Anſ. ·9226—91404824.

(10) Required the cube root of 517·375475—Anſ. 8·0278—19305355048.

(11) Extract the cube root of 20874107909304—Anſ. 27534.

(12) Extract the cube root of 1551328·2159785 15625—Anſ. 115·7625.

(13) Extract the cube root of 98003·449 to 6 places of decimals—Anſ. 461·049037.

(14) What is the cube root of 7154·10916753?—Anſ. 19·26921, &c.

(15) Extract the cube root of 8302348000000· to four places of decimals—Anſ, 20248·8475.

(16) Extract the cube root of 2 to eleven places of decimals—Anſ. 1·25992104989 4.

(17) Extract the cube root of ·0001357 to ten places of decimals—Anſ. ·0513877991 2.

(18) Extract the cube root of $13\frac{3}{5}$ to 9 places of decimals—Anſ. 2·39086030, &c.

(19) Extract the cube root of 92398647506217 to 4 places of decimals—Anſ. 45208·6846.

PROPOSITION II.

To extract the Cube-root of any vulgar Fraction.

1. Reduce the given fraction to its loweſt terms, then extract the cube-root of the numerator for a new numerator, and the cube-root of the denominator for a new denominator.

2. If the fraction will not extract even, reduce it to a decimal, and then extract the cube-root.

3. When the number to be extracted is a mixed fraction, reduce the fractional part to a decimal, and annex it to the whole number, then extract the cube-root.

(20) Extract the cube root of $\frac{2}{5}\frac{4}{7}\frac{3}{6}$.

Firſt $\frac{2}{5}\frac{4}{7}\frac{3}{6} = \frac{2}{6}\frac{7}{4}$; the cube root of 27 is 3, and that of 64 is 4, therefore the cube root of $\frac{27}{64}$ is $\frac{3}{4}$.

(21) Extract the cube root of $\frac{2}{3}$.

$\frac{2}{3} = ·66666$, &c. the cube root of which is ·87358, &c.

(22) What is the cube root of $\frac{1}{4}\frac{7}{7}\frac{5}{0}$?—Anſ. 71638

(23) Required the cube root of $\frac{1}{3}\frac{9}{0}\frac{1}{7}\frac{2}{8}$—Anſ. ·85324

(24) What is the cube root of $\frac{8}{3}\frac{1}{7}\frac{1}{5}$—Anſ. $\frac{3}{5}$

(25) Required the cube root of $\frac{5}{0}$?—Anſ ·82207

(26) What is the cube root of $\frac{2}{2}\frac{3}{4}$?—Anſ. ·98591

The following examples depend upon the 12th and 18th propoſitions of the 12th book of Euclid, and the 33d propoſition of the 11th book; where it is demonſtrated, that all ſolid bodies are in proportion to each other as the cubes of their ſimilar ſides, diameters, lines, &c.

(27) If the diameter of a globe be 1 inch, its ſolidity will be ·5236 inch; what will be the ſolidity of a globe of 15 inches diameter?—Anſ. 1767·15 feet.

(28) The ſolid content of a block of marble is 31185 inches; what will be the ſide of a cubical piece of equal ſolidity?—Anſ. 31 4761

(29) A maſter agreed with a carpenter to make him a cubical bin, to hold 60 quarters of barley; what will be the internal

ternal length of one of its ſides, 2150·42 cubic inches being a Wincheſter buſhel?—Anſ. 101·07 inches.

(30) If a ſtone, 20 inches long, 15 inches broad, and 8 inches thick, weighs 217lb. what will be the length, breadth, and thickneſs, of a ſimilar ſtone that weighs 960olb?—Anſ. 69·2294 length, 51·922 breadth, and 27·6917 depth in inches.

(§. 20.) A general RULE for EXTRACTING the ROOTS of all POWERS.

Rule Point the root into periods as the queſtion requires. Find the neareſt root to the firſt period, and ſubtract its power therefrom; to the remainder bring down the firſt figure in the next period for a dividend. Involve the root to the next lower power, and multiply it by the index of the given power for a diviſor, the quotient is the next figure in the root. Then involve the whole root as before, and ſubtract. Repeat the operation till all the figures are brought down.

Note. When the index of the power to be extracted is a compoſite number, the work may be performed more conciſely than by this general rule. Thus, the ſquare-root of the ſquare-root, gives the biquadrate, or fourth root; the cube-root of the ſquare-root, or the ſquare-root of the cube-root, gives the ſixth root; the ſquare root of the biquadrate root gives the eigth root; the cube root of the cube-root gives the ninth root, &c.—See the Table of Powers.

(1) Extract the 5th root of 3076828211067156 25.

3076828211067156 25 (3145 root.

$3^5 = 3\times3\times3\times3\times3 = 243$ ſubtrahend.

$3^4\times5 = 405$) 646 firſt dividend.

$31^5 = 28629151$ ſubtrahend.

$31^4\times5 = 4617605$) 21391311 ſecond dividend.

$314^5 = 3052447761824$ ſubtrahend.

$3141^4\times5 = 4860585 6080$) 243804402431 third dividend.

$3145^5 = 3076828211067156 25$ ſubtrahend.

(2) Extract the ſquare root of 2—Anſ. 1·414

(3) Required the cube, or third, root of 5—Anſ. 1·709

(4) What is the 4th root of 1728?—Anſ. 6·447

(5) Required

(5) Required the 5th root of 57·54—Anſ. 2·249
(6) Required the 6th root of 3·1416?—Anſ. 1·2102
(7) Required the 7th root of 547·5—Anſ. 2·461
(8) What is the 8th root of 547·5—Anſ. 2·199
(9) Required the 9th root of 1·551328215978515625—Anſ. 1·05

(§. 21.) SIMPLE INTEREST by DECIMALS.

The ratio is the rate per cent divided by 100.

At $2\frac{1}{2}$ per cent the ratio is			At $4\frac{1}{2}$ per cent the ratio is		
	—	·025		—	·045
3	—	·03	5	—	·05
$3\frac{1}{2}$	—	·035	$5\frac{1}{2}$	—	·055
4	—	·04	6	—	·06

*A TABLE *for the ready finding the Decimal Parts of a* Year *equal to any Number of* Days, *or* Quarters *of a* Year.

Day.	Decimal Pt.	Days.	Decimal Pts.	Days.	Decimal Pts.
1	.002739726	10	.02739726	100	.273972602
2	.005479452	20	.05479452	200	.547945205
3	.008219178	30	.08219217	300	.821918068
4	.010958904	40	.109589041	365	1.000000000
5	.013680630	50	.136986631		
6	.016438356	60	.164383561		
7	.019178082	70	.191780821	$\frac{1}{4}$ *of a Year*	·25
8	.021917808	80	.219178082	$\frac{1}{2}$ *of a Year*	·5
9	.024657534	90	.246575342	$\frac{3}{4}$ *of a Year*	·75

Note. The above Table is the ſame as the 9th Decimal Table, page 164 When the number of days cannot be taken out at one view in the above Table, they muſt be taken at twice, or thrice, as in the following Examples.

Thus 200 days	= ·547945205 yr.	30 days	= ·08219217
30	= ·8219217	9	= ·024657534
6	= ·016438356		
236	= ·646575731	39	= ·106849704

PRO-

PROPOSITION I.

Given the Principal, Time, and Rate per Cent. to find the Intereſt or the Amount.

Rule. Multiply the principal, time, and ratio, together, the laſt product will be the intereſt; to which add the principal to find the amount.

(1) What is the amount of 567l. 10s. for 9 years, at 4 per cent per annum.

567·5 principal
9 time

5107·5
·04 ratio

204·300 intereſt
567·5

£771·8 amount = 771l. 16s.

(2) What is the amount of 235l at ſimple intereſt, for $3\frac{3}{4}$ years, at 5 per cent. per annum?—Anſ. 279l. 1s. 3d.

(3) What is the intereſt of 550l for 5 years, at $3\frac{1}{2}$ per cent. per annum?—Anſ. 96l. 5s.

(4) What will 700l. 10s. amount to in $5\frac{1}{4}$ years, at 3 per cent. per annum?—Anſ. 810l. 16s. $6\frac{3}{4}$d. $\frac{3}{5}$.

(5) What will 715l. 15s. amount to in $7\frac{1}{2}$ years, at $4\frac{1}{4}$ per cent. per annum?—Anſ. 943l. 17s. $10\frac{3}{4}$d. ·5.

(6) What is the intereſt of 715l. 15s. for 200 days, at 5 per cent per annum?—Anſ. 23l. 10s. $7\frac{1}{2}$d. 246.

(7) What is the intereſt of 357l. 10s. for 65 days, at 5 per cent. per annum?—Anſ. 3l. 3s. $7\frac{3}{4}$d. ·89.

(8) What will 510l. amount to in 5 years, 120 days, at 5 per cent. per annum?—Anſ. 645l. 17s. 8d. ·055.

PROPOSITION II.

Given the Amount, (or the Intereſt,) Time, and Rate, to find the Principal.

Rule. Multiply the time by the ratio, and add an unit to the product; by this ſum divide the amount, and the quotient will be the principal.—Or, divide the intereſt by the product

duct of the time and ratio, and the quotient will be the principal.

(9) What principal, in 9 years, will amount to 771l. 16s. at 4 per cent. per annum?

9
·04
·36
1·
1·36 divisor

Now 771l. 16s. = £771·8, dividend.
Hence 771·8 ÷ 1·36 = £567·5 = £567 10s. answ.

(10) What principal, put to interest for 9 years, will gain 204l. 6s. interest, at 4 per cent. per annum?

9
·04
·36 divisor.

Now £204 6s. = £204·3, dividend.
Hence 204·3 ÷ ·36 = £567·5 — 567l. 10s. answer.

(11) What principal, in $3\frac{3}{4}$ years, will amount to 279l. 1s. 3d. at 5 per cent. per annum?—Ans. 235l.

(12) What principal, put to interest for 5 years, at $3\frac{1}{2}$ per cent. per annum, will gain 96l. 5s. interest?—Ans. 550l.

(13) What principal, put to interest for $5\frac{1}{4}$ years, will amount to 810l. 16s. $6\frac{3}{4}$d. $\frac{3}{5}$, at 3 per cent. per annum?—Ans. 700l. 10s.

(14) What principal will amount to 943l. 17s. $10\frac{3}{4}$d. $\frac{1}{2}$ in $7\frac{1}{2}$ years, at $4\frac{1}{4}$ per cent. per annum.—Ans. 715l. 15s.

(15) What principal, put to interest for 240 days, at 5 per cent. per annum, will gain 23l. 10s. $7\frac{1}{2}$d. $\frac{18}{73}$?—Ans. 715l. 15s.

(16) What principal, put to interest for 65 days, at 5 per cent. per annum, will gain 3l. 3s. $7\frac{3}{4}$d. $\frac{65}{73}$ interest?—Ans. 357l. 10s.

(17) What principal, put to interest for 5 years and 120 days, at 5 per cent. per annum, will amount to 679l. 8s. 4d. $\frac{1}{4}$ $\frac{7}{73}$?—Ans. 536l. 9s. 7·0027d.

PROPOSITION III.

Given the Principal, Time, and Amount, (or the Interest,) to find the Rate per Cent.

Rule. Divide the difference between the amount and the principal (viz. the interest) by the product of the principal and time, and the quotient will be the ratio, which multiply by 100 to obtain the rate per cent.

(18) At

(18) At what rate per cent. will 567l. 10s. amount to 771l. 16s. in 9 years time?

£711 16 = £771·8
567 10 = 567·5

204·3 dividend.

567·5 × 9 = 5107·5

Then 204·3 ÷ 5107 = ·04. Hence the rate is 4 per cent.

(19) At what rate per cent. will 235l. amount to 279l. 1s. 3d. in $3\frac{3}{4}$ years?—Anſ. 5 per cent.

(20) At what rate per cent. will 550l. gain 96l. 5s. intereſt in 5 years?—Anſ. $3\frac{1}{2}$.

(21) At what rate per cent. will 700l. 10s. amount to 810l. 16s. $6\frac{3}{4}$d. $\frac{3}{5}$ in $5\frac{1}{4}$ years?—Anſ. 3.

(22) At what rate per cent. will 715l. 15s. amount to 943l. 17s. $10\frac{3}{4}$d. $\frac{1}{2}$ in $7\frac{1}{2}$ years?—Anſ. $4\frac{1}{4}$.

(23) At what rate per cent. will 715l. 15s. gain 23l. 10s. $7\frac{1}{2}$d. in 240 days?—Anſ. 5.

(24) At what rate per cent. will 357l. 10s. gain 3l. 3s. $7\frac{3}{4}$d. $\frac{6}{7}\frac{3}{3}$ in 65 days?—Anſ. 5.

(25) At what rate per cent. per annum will 510l. amount to 679l. 8s. $4\frac{1}{4}$d. $\frac{7}{73}$ in 5 years and 120 days?—Anſ. 6l. 4s. 8.14396d.

PROPOSITION IV.

Given the Principal, Rate, and Amount, (or Intereſt,) to find the Time.

Rule. Divide the difference between the amount and the principal (viz. the intereſt) by the product of the principal and ratio, and the quotient will be the time.

(26) In what time will 567l. 10s. amount to 771l. 16s. at 4 per cent. per annum?

£771 16 = £771·8
567 10 = 567·5

204·3 dividend.

567·5 × ·04 = 22·700 diviſor.

Then 204·3 ÷ 22·7 = 9 years, the time required.

(27) In what time will 235l. amount to 279l. 1s. 3d. at $3\frac{1}{2}$ per cent. per annum?—Anſ. $5\frac{23}{56}\frac{5}{8}$ years.

(28) In what time will 550l. gain 96l. 5s. at $3\frac{1}{2}$ per cent. per annum?—Anſ. 5 years.

(29) In what time will 700l. 10s. amount to 810l. 16s. $6\frac{3}{4}$d. $\frac{3}{5}$ at 3 per cent. per annum?—Anſ. $5\frac{1}{4}$ years.

(30) In

(30) In what time will 715l. 15s. amount to 943l. 17s. $10\frac{3}{4}$d. $\frac{1}{2}$ at $4\frac{1}{4}$ per cent. per annum?—Anſ. $7\frac{1}{2}$ years.

(31) In what time will 715l. 15s. gain 23l. 10s. $7\frac{1}{2}$d. $\frac{18}{73}$ at 5 per cent. per annum?—Anſ. 240 days.

(32) In what time will 357l. 10s. gain 3l. 3s. $7\frac{3}{4}$d. $\frac{63}{73}$ at 5 per cent. per annum?—Anſ. 65 days.

(33) In what time will 510l. amount to 679l. 8s. $4\frac{1}{4}$d. $\frac{7}{73}$ at 5 per cent. per annum?—Anſ. 6·64383, &c. years.

(§. 22.) DISCOUNT by DECIMALS.

PROPOSITION.

Any Sum of Money, due ſome Time hence, being given to find its preſent Value to the Creditor, diſcounting at any Rate per Cent.

Rule. As the amount of 1l. for the time given, is to 1l. ſo is the intereſt of the debt for the ſaid time to the diſcount required. Or,

As the amount of 1l. is to 1l. ſo is the debt to the preſent worth.

(1) What is the diſcount and preſent worth of 795l. 11s. 2d. for 11 months, at 6 per cent. per annum?

£795 11 2 = £795·5583

$\frac{11}{12} \times 795{\cdot}5583 \times {\cdot}06 = 43{\cdot}7557083$ intereſt of the debt for 11 months.

$\frac{11}{12} \times {\cdot}06 + 1 = 1{\cdot}055$ amount of 1l. for 11 months.

As 1·055 : 1l. :: 43·7557083 : £41·4746 = 41l. 9s. $5\frac{1}{2}$d. the diſcount of the debt. Then 795l. 11s. 2d. — 41l. 9s. $5\frac{1}{2}$d. = 754l. 1s. 8d. preſent worth.

Or,

As 1·055 : 1 :: 795·5583 : 754·083728 = 754l. 1s. 8d. the preſent worth.

(2) What is the diſcount of 495l. 18s. for 5 months, at $3\frac{3}{4}$ per cent. per annum?—Anſ. 7l. 12s. 7·015d.

(3) What is the preſent worth of 1507l. 14s. 9d. due 7 months hence, at 5 per cent?—Anſ. 1465l. 0s. $1\frac{3}{4}$d. ·773.

(4) What is the diſcount of 7147l. 14s. due 175 days hence, at $3\frac{3}{4}$ per cent?—Anſ. 126l. 4s. 10·072.

(5) What ready money will diſcharge a debt of 1786l. 13s. 4d. due 3 years, 3 quarters, and 29 days hence, diſcounting at $4\frac{1}{3}$l. per cent. per annum?—Anſ. 1534l. 19s. $4\frac{1}{2}$d. ·492.

(§. 23.) EQUATION of PAYMENTS, ON MALCOLM'S PRINCIPLES.

PROPOSITION.

Having two *Debts, due at different Times, to find the equated Time for paying the Whole at once, without Loss either to the Debtor or Creditor.*

Rule 1. Divide the sum of the debts by twice the first payment, multiplied by the ratio; to the quotient add half the time between the two payments, and call the sum the first number found.

2. Multiply the second payment by the time between the two payments, and divide the product by the first payment multiplied by the ratio; call the quotient the second number found.

3. From the square of the first-found number subtract the second, and extract the square-root of the difference.—The first-found number, diminished by this root, will give the equated time, reckoning from the time the first payment is due.

(1) A person has now due to him 320l. and, at the end of 5 years, 96l. more will be due from the same debtor. Now both parties have agreed that the whole shall be paid at once, viz at that time when the interest of the 320l. shall be equal to the discount of the 96l. both being calculated at 5l. per cent. per annum. The time of payment is required?

1st. $320 + 96 = 416$l. sum of the debts.

$320 \times 2 \times \cdot 05 = 32$, the product of twice the first payment by the ratio.

$416 \div 32 = 13$, quotient. Then $13 + \frac{5}{2} = 15 \cdot 5$, the first number found.

2dly. $\overline{96 \times 5} \div \overline{320 \times \cdot 05} = 30$ the second number found.

3dly. $\sqrt{\overline{15 \cdot 5}^2 - 30} = \sqrt{210 \cdot 25} = 14 \cdot 5$, and $15 \cdot 5 - 14 \cdot 5 =$ 1 year, the time which must elapse (after the first payment is due) before the whole ought to be paid together, according to the conditions of the question.

(2) There is 100l. payable 1 year hence, and 105l. payable 3 years hence; what is the equated time, allowing ſimple intereſt, at 5 per cent. per annum?—Anſ. 2 years.

(3) At Michaelmas, 1788, I lent 320l. and at Michaelmas, 1793, 202l. will be due to me from the ſame perſon. Now, on what day, and in what year, may I receive both the debts together, viz. 522l. reckoning intereſt at 5 per cent. per ann?—Anſ. July 3, 1790, the equated time being 1 year, 277 days.

(§. 24.) COMPOUND INTEREST by DECIMALS.

Rates per Cent.	The amounts of £1, for		
	Yearly payments.	½ yearly payments.	Quarterly payments.
3	1·03	1·015	1·0075
3½	1·035	1·0175	1·00875
4	1·04	1·02	1·01
4½	1·045	1·0225	1·01125
5	1·05	1·025	1·0125
5½	1·055	1·0275	1·01375
6	1·06	1·03	1·015

The amounts in the preceding table, are calculated thus,

100 : 100+3 :: 1 : 1·03 for yearly payments.
100 : 100+1½ :: 1 : 1·015 for ½-yearly payments.
100 : 100+¾ :: 1 : 1·0075 for quarterly payments.

PROPOSITION I.

Given the Principal, Rate, and Time, to find the Amount or Intereſt.

Rule. Find the amount of one pound for the time of the firſt payment, and multiply it by itſelf ſo often as are the number of payments wanting 1, that is, twice by itſelf if there be three payments, thrice if there be four, &c. then the laſt product multiplied by the principal gives the whole amount, from which ſubtract the principal, the remainder will be the intereſt.

Note. The following table, adapted to the uſe of the above rule, contains the amount of 1 pound for each of the firſt 10 years of payments, at ſeven ſeveral rates of intereſt, from 2 and a half to 6 per cent. and therefore any one of theſe numbers multiplied by a given ſum, produces its amount for the correſponding rate and time.

No.

N°	2½	3	3½	4	4½	5	6
1	1·025	1·03000	1·03500	1·04060	1·04500	1·05000	1·06000
2	1·05062	1·06090	1·07122	1·08160	1·09202	1·10250	1·12360
3	1·07689	1·09273	1·10872	1·12486	1·14117	1·15762	1·19102
4	1·10381	1·12551	1·14752	1·16986	1·19252	1·21551	1·26248
5	1·13141	1·15927	1·18769	1·21665	1·24618	1·27628	1·33823
6	1·15969	1·19405	1·22926	1·26532	1·30226	1·34010	1·41852
7	1·18869	1·22987	1·27228	1·31593	1·36086	1·40710	1·50363
8	1·21840	1·26677	1·31681	1·36857	1·42210	1·47746	1·59385
9	1·24886	1·30477	1·36290	1·42331	1·48610	1·55133	1·68948
10	1·28008	1·34392	1·41060	1·48024	1·55297	1·62889	1·79085

(1) What will 200l. amount to in 6 years, at 5 per cent. per annum, compound intereſt, and what intereſt will it gain?

Here the amount of 1l. for the firſt payment is £1·05, and 1·05×1·05×1·05×1·05×1·05×1·05 = 1·340095640625. This, multiplied by 200, gives 268.019128125 = £268 0 4½·363 the amount; from which deduct 200l. the principal, and the remainder, 68l. 0s. 4½d. 363, will be the intereſt.

(2) What will 275l. amount to in 3 years, at 5 per cent. per annum, compound intereſt?—Anſ. 318l. 6s. 11¼d.

(3) What is the compound intereſt of 700l. 15s. for 7 years, at 4 per cent. per annum?—Anſ. 221l. 7s. 9¼d. ·64

(4) What is the compound intereſt of 800l. for 9 years, at 5 per cent per annum?—Anſ. 441l. 1s. 3·14d.

Proposition II.

Given the Amount, Rate, and Time, to find the Principal.

Rule. As the amount of 1l. at the rate and for the time given, is to 1l. ſo is the amount given to the principal required.

(5) What principal, put to intereſt for 6 years, will amount to 268l. 0s. 4½d·363 at 6 per cent. per annum?

Firſt, £268 0 4½·363 = 268·019128125, and 1·05 × 1·05 × 1·05 × 1·05 × 1·05 × 1·05 = 1·340095640625 amount of 1l. for 6 years. Hence

As 1·340095640625 : 1l. :: 268·019128125 : 200l. the principal required.

(6) What principal, put to intereſt for 3 years, will amount to 318l. 6s. 11¼d. at 5 per cent. per annum?—Anſ. 275l.

(7) What principal, put to intereſt for 4 years, at 4 per cent. per annum, will amount to 819l. 15s. $6\frac{3}{4}$d·2504832?—Anſ. 700l. 15s.

(8) What principal, put to intereſt for 9 years, at 5 per cent. per annum, will amount to 1241l. 18s. 3·017467875d?—Anſ. 800l.

(§. 25.) DISCOUNT at COMPOUND INTEREST.

Any Sum of Money, due ſome Time hence, being given to find its preſent Value to the Creditor, diſcounting at any Rate per Cent. Compound Intereſt.

Rule. As the amount of 1l. at the rate and for the time given is to 1l. ſo is the debt to its preſent value, Or,

As the amount of 1l. at the rate and for the time given is to the intereſt of 1l. for the ſame time, ſo is the debt to the diſcount.

(1) What is the preſent worth and diſcount of 243l. $2\frac{1}{40}$s. due 4 years hence, diſcounting at 5 per cent. per annum?

Firſt, £243 $2\frac{1}{40}$s.=243·10125

1·05×1·05×1·05×1·05=1·21550625, the amount of 1l. for 4 years.

As 1·21550625 : 1 :: 243·10125 : 200l. the preſent worth.

Or, 1·21550625—1=·21550625 the intereſt of 1l. for 4 years.

As 1·21550625 : ·21550625 :: 243·10125 : 43·10125l.=43. $2\frac{1}{40}$ the diſcount.

(2) What is the preſent worth and diſcount of a debt of 400l. due 4 years hence, at 5 per cent. per annum?—Anſ. 329l. 1s. $7\frac{1}{4}$·76 preſent worth; and 70l. 18s. $4\frac{1}{2}$d·2 the diſcount.

(3) If 643l. 4s. 11d. be payable in 6 years, what is the preſent worth, diſcounting at 5 per cent. per annum?—Anſ. 480l.

(4) A perſon has 500l. due at 5 different times, viz. 100l. at 1 year's end, 100l. more at the end of 2 years, 100l. more at the end of 3 years, 100l. more at the end of 4 years, and 100l. more at the end of 5 years. What is the preſent worth of the whole, diſcounting at 6 per cent. per annum?—Anſ. 421·236378l.=421l. 4s. 8·731d.

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TO

ARITHMETIC.

PART V.

(§. 1.) DUODECIMALS, with their application to ARTIFICERS' WORK.

DEFINITION. Duodecimals are so called because every superior place is 12 times its next inferior in that scale of notation. This way of conceiving an unit to be divided, is chiefly in use among *Artificers*, who generally take the linear dimensions of their work in *feet*, *inches*, and *parts*.

(§. 2.) TABLES of the DIFFERENT MEASURES.

Table I. MEASURES of SQUARE FEET.

This kind of measure is chiefly used by glaziers, and sometimes by masons and other workmen: its several denominations are as follow.

			Marked.
12 Fourths	make	1 Third	‴
12 Thirds	—	1 Second	″
12 Seconds	—	1 Prime, or inch	′
12 Inches, or primes		1 Foot	Ft.

A ſtone of glaſs is 5lb. a ſeam 24 ſtone, and a cheſt from 200 to 300 ſquare-feet.

Note. It is needleſs to take notice of any denomination leſs than ſeconds, though this manner of ſub-dividing a foot ſquare is endleſs.

Table II. MEASURES of SQUARE YARDS.

The workmen who principally make uſe of this meaſure are plaſterers, joiners, painters, paviors, &c. The ſeveral denominations of which are as follow:

			Marked.
12 Fourths	make	1 Third	‴
12 Thirds	—	1 Second	″
12 Seconds	—	1 Prime	′
12 Primes	—	1 Foot	Ft.
9 Feet	—	1 Yard ſquare	yd.

Note. It is not neceſſary, in Practice, to take notice of any denominations in this meaſure leſs than primes or inches.

Table III. MEASURES of the SQUARE of 100 FEET.

This kind of meaſure is commonly uſed by carpenters in flooring, partitioning, and roofing, and by bricklayers, &c. in tiling and ſlating, &c. The denominations are as follow:

			Marked.
12 Seconds	make	1 Prime	′
12 Primes	—	1 Foot	Ft.
25 Feet	—	1 Quarter of Square	Q.
4 Quarters	—	1 Square	

In ſome places they make uſe of the ſquare of 324 feet, or 18 by 18.

Note. Addition and Subtraction of Duodecimals are ſo eaſy as to render any example ſuperfluous.

(§. 13.)

(§. 3.) A general RULE for multiplying duodecimally, or ſquaring the DIMENSIONS of ARTIFICERS WORK.

Under the multiplicand write the correſponding denominations of the multiplier. Multiply each term in the multiplicand, beginning at the loweſt, by the feet in the multiplier; write each reſult under its reſpective term, obſerving to carry an unit for every 12, from each lower denomination to its next ſuperior. In the ſame manner multiply all the multiplicand by the inches in the multiplier, and write the reſult of each term one place removed to the right hand of thoſe in the multiplicand. Work in a ſimilar manner with the ſeconds in the multiplier, ſetting the reſult of each term removed two places to the right hand of thoſe in the multiplicand. Proceed in like manner with the reſt of the denominations, and their ſum will give the anſwer required.

Note. This may be performed by the rule of practice; thus, after you have multiplied by the feet, take aliquot parts of the multiplicand, with the inches, &c. Or the inches, &c. may be reduced to the fraction of a foot, and then multiply together. Or turn the inches, &c. into the decimal of a foot, and then multiply them together by ſome of the rules in multiplication of decimals.

(1) Multiply 4ft 6in. 5 parts by 9ft 4in. 7 parts.

Ft	In.	Pts		
4	6	5		
9	4	7		
40	9	9	prod. by 9 feet.	
1	6	1	8	ditto by 4 in.
	2	7	8 11	ditto by 7pts
Prod. 42	6	6′	4″ 11‴	

By Practice.

		Ft	In.	Pts	
4in.	1/3	4	6	5	
				9	
		40	9	9	
6′	1/6	1	6	1	8″
1′	1/12		2	3	2 6‴
				4	6 5
		42	6	6	4 11

Note. The ſame anſwer may be exactly found either by fractions or decimals.

(2) Mult. 7ft 5in by 4ft 7in.—Anſ. 33ft 11in 11pts.
(3) Mult. 9ft 6in by 8ft 7in.—Anſ. 81ft 6in 6pts.
(4) Mult. 3ft 11in by 9ft 10in.—Anſ. 38ft 6in 2pts.
(5) Mult. 25ft 6in. by 34ft 9in.—Anſ. 886ft 1in 6pts.
(6) Mult. 15ft 7in by 5ft 11in.—Anſ. 92ft 2in 5pts.
(7) Mult. 297ft 9in by 7ft 10in.—Anſ. 2232ft 4in 6pts.
(8) Mult. 77ft 3in 6pts by 54ft 4in 7pts—Anſ. 4203ft 3in 3pts 0″ 6‴.

(9) Mult. 15ft 3in 6pts 5″ by itſelf.—Anſ. 233ft 11in opts 11″ 11‴ 2ⁱᵛ 1ᵛ.

(10) Multiply 10ft 4in 5pts by 7ft 8in 9pts.—— Anſ. 80ft 11in 7pts 7″ 9‴.

(11) Mult. 25ft 11in 6pts 8″ 7‴ by itſelf.—Anſ. 674ft 11in 1pts 4″ 7‴ 11ⁱᵛ 1ᵛ 8ᵛⁱ 1ᵛⁱⁱ.

(§. 4.) The APPLICATION of DUODECIMALS.

By the help of the two following propoſitions and rules, are calculated the areas of all right-lined figures.

PROPOSITION I.

To find the Area of a Parallelogram, whether it be a Square, a Rectangle, a Rhombus, or a Rhomboides.

Rule. Multiply the length by the height, or perpendicular breadth, and the product will be the area.

(1) Required the area of a parallelogram of 14ft 9in in length, and 4ft 6in in breadth?—Anſ. 66ft 4in 6pts.

PROPOSITION II.

To find the Area of any right-lined Triangle, having the Baſe and Perpendicular Height given.

Rule. Multiply the baſe by the perpendicular height, and half the product will be the area. Or, multiply the baſe by half the perpendicular, or the perpendicular by half the baſe, and the product will be the area.

(2) How many ſquare yards are in a triangle, if the baſe be 49 feet, and the perpendicular height 25ft 3in?—Anſ. 68 yards, 6ft 7in.

(§. 5.) GLAZIERS WORK.

Glaziers generally meaſure their work to $\frac{1}{8}$ of an inch; and never make any allowance for round or oval windows, but meaſure them as if they were ſquare or rectangular. Plumbers work is generally done by the pound or hundred weight.

(1) xii. If a window be 7ft 3in high, and 3ft 5in broad, how many ſquare feet of glazing are contained therein?—Anſ. 24ft 9′ 3″.

(2) xiii. There is a houſe with three tiers of windows, 7 in a tier; the height of the firſt tier is 6ft 11in, of the ſecond 5ft 4in, and of the third 4ft 3in; the breadth of each window is 3ft 6in, what will the glazing come to at 14½d. per foot?—Anſ. 24l. 8s. 5½d.

(3)* What will the glazing a triangular ſky-light come to at 10d. per foot; the baſe being 12 feet 6 inches long, and the perpendicular height 16ft 9in?—Anſ. 4l. 7s. 2¾d.

(4)* What is the area of an elliptical window of 14ft 6in in length, and 4ft 9in in breadth?—Anſ. 68ft 10in 6″

(§. 6.) PLASTERERS WORK.

1. Plaſterers work is generally of two kinds, plaſtering upon laths, called ceiling; and plaſtering upon walls, called rendering. In meaſuring rendering upon brick walls there are no deductions made, but in meaſuring rendering between quarters, in partitions between rooms, there is commonly one fifth part of the whole area deducted, if it be not whitened or coloured; but if it be, there is generally one fifth part added to the whole area.

2. Deductions muſt be made for chimnies, doors, windows, and other parts that are not plaſtered. In arches the girt round, multiplied by the length, gives the area.

(1) xvii. What will be the expence of plaſtering a ceiling, at 11½d. per yard, ſuppoſing the length 22ft 7in, and breadth 13ft 11in?—Anſ. 1l. 13s. 5½d.

(2)* There is a partition which meaſures 234ft 8in round, and 14ft 6in high, which is rendered between quarters. The lathing and plaſtering will be 8d. per yard, and the whitening 2d. per yard, what will the whole come to?—Anſ. 131. 17s. 2¾d.

(3)* The length of a room is 14ft 5in, breadth 13ft 2in, and height 9ft 3in to the under ſide of the cornice, which projects 5in from the wall, on the upper part next the ceiling; required the quantity of rendering and plaſtering, there being no deductons but for one door, the ſize whereof is 7ft by 4?—Anſ. 53yds 5ft 3in 6″ of rendering, and 18yds 5ft 6in 4″ of ceiling.

(4)* The

(4)* The circular vaulted roof of a church meaſures 105ft 6in in the arch, and 257ft 5in in the length, what will the plaſtering come to at 1s. per yard?—Anſ. 150l. 17s. 4¾d.

(§. 7.) JOINERS WORK.

1. Joiners meaſure their work in height with a ſtring. When flooring is meaſured by itſelf, the dimenſions are taken the whole inſide length and breadth of the room. Partitions are meaſured from wall to wall, and from floor to floor, girting the ſtring over all the mouldings, &c. and no deductions are made for door ways, on account of the trouble of framing them.

2. In roofing, the length of the houſe on the inſide with ⅔ of the thickneſs of one gable is conſidered as the length. When the rafters are ¾ of the breadth of the building, the roof is ſaid to be of a *true pitch*, and then the flat and half the ſlat within the walls, is conſidered as the content. Wainſcotting is meaſured in a manner ſimilar to partitioning; deduction muſt be made for chimnies, doors, and windows, which are meaſured ſeparately.

3. Shutters and doors being worked on both ſides, are reckoned work and half.

(1)* What will the wainſcotting a room come to at 6s. per ſquare-yard, ſuppoſing the height of the room, including the cornice and moulding, be 12ft 6in, and the compaſs 83ft 8in; 3 window ſhutters each 7ft 8in by 3ft 6, and the door 7ft by 3ft 6in; the ſhutters and doors being worked on both ſides are reckoned work and half?—Anſ. 36l. 12s. 2½d.

(2)* Suppoſe a houſe of three ſtories, beſides the ground floor, was to be floored at 6l. 10s. per ſquare; the houſe meaſures 20ft 8in, by 16ft 9in; there are 7 fire-places, the meaſures whereof are; two, each of 6ft by 4ft 6in; two other, each of 6ft by 5ft 4in; and two, each of 5ft 8in, by 4ft 8in; and the ſeventh, 5ft 2in by 4ft. The well-hole for the ſtairs is 10ft 6in, by 8ft 9in; what will the whole come to?—Anſ. 53l. 13s. 3¼d.

(3)* In 173ft 10in in length, and 10ft 7in in height of partitioning, how many ſquares?—Anſ. 18ſq 39ft 8in 10pts.

(4)* If a houſe meaſure 52ft 8in in length within the walls, and 30ft 6in in breadth, and the roof be of a true pitch, what will it coſt roofing at 10s. 6d. per ſquare?—Anſ. 12l. 12s. 11¾d.

(5)* A rec-

(5)* A rectangular four-ſided room meaſures 129ft 6in round, and is to be wainſcotted at 3s. 6d. per yard ſquare; after the due allowance for girt of cornice, &c. it is 16ft 3in high; the door is 7ft 3in by 4ft 6in; the cheek-boards round them come 15 inches below the ſhutters, and are 14 inches in breadth; the lining boards round the door-way are 16 inches broad; the door and window-ſhutters being worked on both ſides, are reckoned as work and half, and paid for accordingly; the chimney 3ft 9in by 3ft, not being encloſed, is to be deducted from the ſuperficial content of the room. The eſtimate of the charge is required?—Anſ. 43l. 4s. 6d.

(§. 8.) PAINTERS WORK.

Painters take their dimenſions with a ſtring, and meaſure from the top of the cornice to the floor, for every part whereon their colour is laid muſt be meaſured, ſo the line muſt be forced cloſe into all mouldings, &c. Their price is generally proportionable to the number of times they lay their colour on. Windows are commonly painted at ſo much per piece. For carved mouldings, &c. it is cuſtomary to allow double the meaſure reſulting from the multiplication of the length by the girt. Deductions muſt be made for chimnies, caſements, &c. if any within the dimenſions taken.

(1) xviii. A gentleman had a room painted at 8½d. per yard, the meaſure whereof is as follows: the height 11ft 7in, the compaſs 74ft 10in, the door 7ft 6in by 3ft 9in; five window-ſhutters, each 6ft 8in by 3ft 4in, the breaks in the windows 14in deep and 8ft high; the chimney 6ft 9in by 5ft; the ſhutters and doors being coloured on both ſides; what will the whole come to?—Anſ. 4l. 6s. 11d.

(2)* Suppoſe a room were to be painted, and that its length is 24ft 6in, its breadth 16ft 3in, and height 12ft 9in; alſo the ſize of the door 7ft by 3ft 6in, and the ſize of the window-ſhutters to each of the windows, there being two, is 7ft 9in by 3ft 6in; but the breaks of the windows themſelves are 8ft 6in high, and 1ft 3in deep; what will be the expence of giving it 3 coats, at 2d per yard each; the ſize of the chimney to be deducted being 5ft by 5ft 6in?—Anſ. 3l. 3s. 10½d.

(§. 9.) PAVIORS WORK.

(1) xiv. What will the paving a court-yard come to at 3s. 4d. per yard, the length being 24ft 5in, and breadth 12ft 7in?—Anſ. 5l. 13s. 9½d.

(2) xv. What will be the expence of paving a rectangular court yard, its length being 62ft 7in, and breadth 44ft 5in, and in which there is laid a foot-path the whole length of it, and 5½ft broad, with broad ſtones at 3s. per yard, the reſt being paved with pebbles at 2s. 6d. per yard?—Anſ. 39l. 11s. 3¼d.

(§. 10.) BRICKLAYERS WORK.

1. Bricklayers always value their work at the rate of 1½ brick thick, therefore the content of the wall, &c. muſt be multiplied by the number of ½ bricks it is in thickneſs, and then be divided by 3, before the value of the work is eſtimated. They likewiſe meaſure their work by the rod of 16½ft, the ſquare of which is 272¼ft; but in practice the ¼ of a foot is generally rejected.

2. When walls join in an angle, meaſure the length of the one on the outſide, and the other on the inſide; or, from the ſum of the outſide lengths deduct the thickneſs of the wall.

3. In meaſuring a gable-end, becauſe it is a triangle, multiply the breadth at the bottom by the perpendicular height, and take half the product.

4. Chimnies are meaſured as if they were ſolid, on account of the trouble attending them, deducting only the vacuity between the jambs from the hearth to the mantle.

5. All windows, doors, &c. are to be deducted out of the contents of the walls in which they are placed.

(1) xx. How many ſquare rods are there in a wall 63½ feet long, 14 feet 11 inches high, and 2½ bricks in thickneſs? Anſ. 5 rods, 218ft, 8in, 2pts.

(2) xxi. Admit the end-wall of a houſe to be 28ft 10in in breadth, and the height of the roof from the ground 55ft 8in in the gable (or triangular part above the ſide walls) to riſe 42 courſes of bricks, reckoning 4 courſes to a foot; and that 20ft high be 2½ bricks thick, 20ft more 2 bricks thick, and the remaining 15ft 8in 1½ brick thick; what will the work

work come to at 5l. per rod, the gable being 1 brick in thickneſs?—Anſ. 48l. 13s. 5¼d.

(3)* What will the tiling a barn coſt, at 25s. 6d. per ſquare, the length being 43ft 10in, and breadth 27ft 5in on the flat, the eaves boards projecting 16in on each ſide?—Anſ. 24l. 9s. 5½d.

A PROMISCUOUS COLLECTION of QUESTIONS.

(1) Required the ſum of 157 added 495 times to itſelf?—Anſ. 77715.—K 52, page 3.

(2) Let 954 be added 435 times to itſelf, and ſhew what the laſt ſum total exceeds or falls ſhort of four hundred and fifteen thouſand.—Anſ. 10 ſhort.—K 53, p. 3.

(3) What is the difference between thrice ſix, and twenty, and thrice twenty-ſix?—Anſ. 40.—K 55, p. 3.

(4) A farmer had 5 ſons, to whom he left 500l. in caſh, and 5 bills of 84l. 10s. 6d. each; he ordered his debts to be paid, amounting to 120l. and 20l. to be expended at his funeral; the reſidue was to be divided in this manner; the eldeſt ſon was to have a fourth part, and each of the other ſons to have equal ſhares; what was the ſhare of each ſon?—Anſ. 195l. 13s. 1½d. the eldeſt ſon's ſhare; and 146l. 14s. 10d. each of the other's ſhare.—K 87, p. 12.

*(5) If 102lb at Rotterdam make 112lb at Cork, and the exchange between London and Cork be 8 per cent. in favour of London, and the exchange between London and Rotterdam 34s. Flemiſh per £ ſterling; how many guilders will 100 Flemiſh lbs of tallow (bought at Cork for 27l. the tun Iriſh) coſt at Rotterdam, excluſive of freight and charges?—Anſ. 12 guilders, 10 ſtivers.

(6) I have imported 87 jars of Lucca oil, each containing 57 gallons; what came the freight to at 5s. 3d. per cwt. neat, reckoning 1lb in 111lb for tare, and 7½lb of oil to a gallon?—Anſ. 79l. 4s. 10¾d.—K 30, p. 78.

(7) What is the compound intereſt of 740l. 18s. for 9¼ years, by quarterly payments, at 4 per cent. per annum?—Anſ. 329l. 15s. 1½d.—K 8, p. 96.

(8) A merchant bought 100 yards of velvet for 112l. at what rate muſt he ſell it per yard, to gain as much by the whole quantity as four yards are ſold for?—Anſ. 1l. 3s. 4d.—K 29, p. 112.

(9) A certain village is poſſeſſed by three proprietors, who are deſirous of having it encloſed for their mutual benefit. A's property, upon a ſurvey of the quantity and quality, is 394a. 3r. 34p. at 18s. per acre; B has 417a. 1r. 14p. at an average of 19s. 6d. per acre; and C has 714a. 3r. at a guinea an acre. Out of theſe an allowance of 5s 6d. in the pound is to be made for the tithes. What quantity of land muſt be allotted for theſe tithes, at an average quality of 19s. 9½d. per acre?—Anſ. * 420a. 1r. 26p.—K 14, p. 108.

(10) If the par of exchange between London and Amſterdam be 37⅕s. Flemiſh per £ ſterling, what does London gain or loſe per cent. by drawing bills upon Holland at 33s. 4d. Flemiſh per £ ſterling?—Anſ. 10l. 3s. 7d. $\frac{76}{187}$ loſs per cent. —K 71, p. 124.

(11) Divide 500l. amongſt 4 people, thus; give A ½, B ⅓, C ¼, and D ⅕.

	l.	s.	d.			
Anſwer.	194	16	1	rem. 76	A's ſhare	K 12, p. 101
	129	17	4¾	— 25	B's ——	
	97	8	0½	— 38	C's ——	
	77	18	5¼	— 15	D's ——	

(12) If 3yds, 3qr of Kerſey coſt 8s. 9d. what will 257 yds, 2qr coſt? Anſ. 30l. 8s. 4d.—K 8, p. 21.

(13) Three boys, A, B, and C, won together 97 marbles, at play; now, if the number of marbles B won be added to the number C won, they will make 60; and, if the number A won be added to the number C won, they will make 62. How many marbles did each boy win ſeparately?—Anſ. A won 37, B 35, and C 25.—K 12, p. 2.

(14) There are two numbers; the greater is 19 times 508, and their difference is 15 times 112; required the ſum and product of thoſe numbers.—Anſ. 17624 ſum, and 76945744 product.—K 56, p. 3.

(15) A merchant of Amſterdam orders his factor at London to remit to his correſpondent at Paris at 53d. ſterling per crown, and to draw upon Rotterdam for the value at 32s. Flemiſh per £ ſterling; but, when the order came to hand, the exchange was on Paris, at 54d. per crown. At what rate of exchange ought the factor to draw upon Rotterdam, to execute his orders without loſs to his employer?—Anſ. 31 $\frac{1}{27}$s. Flemiſh per £ ſterling.—K 79, p. 125.

* This anſwer differs from the anſwer in the Key to the Complete Practical Arithmetician, (2r. 30p.) occaſioned by a miſtake in the work of the laſt ſtating but one in the Key.

(16) A common pasture, containing 54a 1r 35p; another, containing 54a 2r; and a third, containing 39a 13p, are to be inclosed and divided among 60 parishioners; what is each man's share, after deducting 21a 2r for tithes, admitting the land to be equally good?—Ans. 2a $17\frac{7}{5}$p —K 28, p. 8.

(17) A country gentleman ordered 58l. 14s. to be distributed among the poor inhabitants of 4 villages. Those of the place of his residence were to have 1s. each; those of the next 8d.; the next were to have 6d. and the last 4d. each; four persons, (one out of each village,) who shared in the bounty, were appointed to distribute the money. Now, admitting the number of indigent persons in each village to be equal, how many partook of this charity, the men who distributed the money being allowed 5s. $4\frac{1}{2}$d. each, extra?—Ans. 1844 people.—K 82, p. 11.

(18) Place four sevens in such a manner that they may be equal to 78.—Ans. see K 21, p. 24.

(19) Admit the length of a ship's keel to be 125 feet, the breadth of the mid-ship beam 25 feet, and the depth of the hold 15 feet, required the dimensions of two other ships, of a similar construction, the one to carry three times, the other $\frac{1}{2}$ the burthen of that given above?

Dimensions of the first ship.

Answer { 180·28 feet the keel
36·05 — mid-ship beam
21·6 — depth of the hold

Dimensions of the second ship.

99·21 feet the keel
19·84 — mid-ship beam
11·905 depth of the hold
} K 31, p. 149.

(20) A sugar loaf, in the form of a cone, the perpendicular height whereof is 20 inches, is to be divided into 3 equal parts; what will be the perpendicular height of each part?—Ans. 13·8672 inches, the height of the top part; 3·6044 height of the middle part; 2·5284 height of the bottom part. K 32, p. 149.

(21) In a Jacobus, a Carolus, 5 angels, 3 marks, $5\frac{1}{2}$ nobles, 6 testers, and 90 groats, how many farthings?—Ans. 9968 farthings—K 22, p. 9.

(22) A person sold a hogshead of sugar, weighing 7cwt. 3qr 14lb, how much pure sugar was contained in it; thirteen times the weight of the dross and hhd being equal to the

weight of pure ſugar?—Anſ. 7cwt 1qr 7lb weight of pure ſugar.—K 30, p. 8.

(23) In 7hhds of oil, each weighing 3 cwt, 2qr 14lb groſs, tare 21lb per cwt. how many gallons neat, and what is the value at 5s. 4d. per gallon?—Anſ. 307$\frac{3}{10}$gal. neat, and 82l. 2s. 0$\frac{1}{2}$d. the value.—K 29, p. 78.

(24)* A man being aſked his age, replied, "the ſixth part of my age was ſpent in childhood, the fourth part in youth, the third part in manhood, and 18 years in old age." what might his age be?—Anſ. 72 years.

(25)* Suppoſe a 10 foot ladder to ſtand upright againſt a wall of 10 feet high; if the foot of the ladder be pulled 6 feet from the bottom of the wall along the pavement, how far will the top of the ladder deſcend from the top of the wall?—Anſ. 2 feet.

(26)* Required the leaſt whole number, which, if divided by 2, there will remain 1; if divided by 3 there will remain 1; and ſo likewiſe when it is divided by 4, 6, 8, or 12, there may ſtill remain 1, but being divided by 5 there may remain nothing?—Anſ. The leaſt common multiple of the above diviſors is 24, to which add an unit for the anſwer, viz. 25.

(27) A lent his friend B 91 guineas, from the 11th of December, 1791, till the 10th of May, 1792; B, on another occaſion, let A have 66l. 13s. 4d. from September 3, 1793, to Chriſtmas 1794; how long ought the perſon *obliged* to lend his friend 40l. to retaliate the favour?—Anſ. A muſt lend B 40l. for 438$\frac{17}{48}$ days—K 11, p. 19.

(28) If the national debt be 239219796l. 7s. 9d. how long a foot path, of a yard wide, would this ſum pave, if reduced to guineas, admitting a guinea to be exactly one inch in diameter.—Anſ. 99 miles, 7·c633 furlongs.—K 16, p. 154.

(29) If 4 compoſitors, in 16 days of 12 hours long, can compoſe 14 ſheets, of 24 pages in each ſheet, 44 lines in a page, and 40 letters in a line, in how many days, of 10 hours long, may 9 compoſitors compoſe a volume, to be printed on the ſame latter, conſiſting of 30 ſheets, 16 pages in a ſheet, 48 lines in a page, and 45 letters in a line?—Anſ. 14$\frac{5}{33}\frac{1}{12}\frac{8}{24}$ days, or 14$\frac{7}{77}$ days.

(30) Bought 17$\frac{1}{4}$ hhds of ſugar, each 10cwt 1qr 14lb, tare 7lb per cwt, tret 4lb per 104lb, what is the value at 1l. 12$\frac{1}{8}$s. per cwt neat?—Anſ. 259l. 0s. 5$\frac{3}{4}$d.—K 25, p. 77.

(31) A young gentleman, whoſe father has been dead 12 years, is informed by his guardian that his fortune amounts in

in cash to 26416l. and that they have allowed him 5 per cent simple interest, for the use of the money his father left him, except 100l. which was deducted annually for his education; if the gentleman is now 21 years of age, pray what money did his father leave him?—Ans. 17260l.—K 35, p. 83.

(32) What is the amount of 715l. for 6 years, the interest payable half-yearly, at $4\frac{1}{4}$ per cent. per annum?—Ans. 920l. 4s. $4\frac{1}{4}$d.—K 7, p. 95.

(33) If, when Port wine is $17\frac{1}{2}$ guineas per hhd, a company of 47 people will spend 21 guineas therein, in a certain time, what is wine a pipe when 15 persons more will spend 65 guineas in twice the time, drinking at the same rate?—Ans. 43l. 2s. $3\frac{1}{2}$d. $\frac{10}{31}$—K 39, p. 18.

(34) A hare, pursued by a greyhound, is 144 of her leaps before him at setting off; now the hare makes 4 leaps while the greyhound makes 3, but the greyhound leaps as far at twice as the hare does at thrice; how many leaps must the greyhound take to catch the hare?—Ans. 864 leaps.—K 33, p. 16.

(35) The great bell at Oxford, the heaviest in England, weighs 7t 11cwt 3qr 4lb. St. Paul's bell, at London, weighs 5t 2cwt 1qr 22lb, and Tom of Lincoln weighs 4t 16cwt 3qr 18lb, how much are these bells together inferior in weight to the great bell at Moscow, the largest in the world, which weighs 198t 2cwt 1qr?—Ans. 180t 11cwt 12lb.—K 58, p. 6.

(36) A gentleman has two sons, the age of the elder added to his makes 126 years, and the age of the younger son is equal to the difference between the age of the father and the elder son. Now if the father be 80 years of age, how old are each of his sons?—Ans. the elder is 46 years, and the younger 34 years of age.—K 11, p. 2.

(37) Required the product of eleven thousand, eleven hundred, and eleven; by twelve thousand, twelve hundred, and twelve?—Ans. 160010532.—K 54, p. 3.

(38)* A gentleman courted a lady, and as their birth-days happened together, they agreed to make that their wedding-day. On the day of marriage, it happened that the gentleman's age was just double to that of the lady's, that is as 2 is to 1. After they had lived together 30 years, the gentleman observed that his lady's age drew nearer to his, and that his was only in such proportion to hers as 2 is to $1\frac{1}{7}$; thirty years after this, the gentleman found his, and his lady's age to be as near as 2 is to $1\frac{1}{5}$; at which time they both died. I

demand their ſeveral ages at the day of their marriage, and of their death?—Anſ. On their wedding day the lady was 20 years old, and the gentleman 40; and on the day of their death he was 100 years old, and ſhe was 80.

(39) A merchant at Amſterdam was indebted to another at Paris a bill of 3000 florins current, agio 4 per cent. and exchange at 90½d. per ecu of 60 ſous Tournois; but, when this bill became negociable, the exchange was down at 89½d. per crown, and the agio advanced to 5 per cent. Did the Paris merchant gain or loſe by this turn of affairs?—Anſ. The Paris merchant gained 1 crown, 58 ſols.—K 84, p. 127.

(40) A merchant, A, of London, ſent 8752 yards of cloth, worth 1l. 11s. 6d. per yard, to B in Jamaica; and deſired him to return him $\frac{1}{4}$ of the value in ſugar, at 1l. 15s. 6d. per cwt.; $\frac{1}{3}$ of the value in pepper, at 7l. 3s. 9d. per cwt. and the reſt in rum at 5s. 6d. per gallon. Each merchant ran the riſk, and paid the charges of the commodity he ſent over; pray what quantity of ſugar, pepper, and rum, did A receive?—Anſ. 1941cwt 1qr $24\frac{4}{7}$lb of ſugar; 2390cwt 2qr $25\frac{15}{37}$lb of pepper, and $31328\frac{2}{11}$ gallons of rum.—K 16, p. 116.

(41) What number, divided by 1185, will give 497 for the quotient, and leave juſt a fifth part of the diviſor remaining?—Anſ. 589182.—K 55, p. 4.

(42) Subtract 759 out of 171493745 as often as you can, and ſhew what the laſt remainder exceeds or falls ſhort of 500?—Anſ. the laſt remainder exceeds 500 by 231.—K 57, p. 4.

(43) What part of 3d. is $\frac{4}{5}$ of 6d.?—Anſ. $\frac{8}{5}$.—K 1, p. 42.

(44) If $\frac{3}{11}$ of a ſhip be worth 4000 guineas, what is the whole worth?—Anſ. 14200l.—K 4, p. 42.

(45) If 248 men, in $5\frac{1}{2}$ days, of 11 hours each, dig a trench of 7 degrees of hardneſs, $232\frac{1}{2}$ yards long, $3\frac{2}{3}$ wide, and $2\frac{1}{4}$ deep; in how many days, of 9 hours long, will 24 men dig a trench of 4 degrees of hardneſs, $357\frac{1}{2}$ yards long, $5\frac{3}{5}$ wide, and $3\frac{1}{2}$ deep? ſuppoſing the earth of each trench to be caſt into wheelbarrows, and taken away by other men appointed for that purpoſe.—Anſ. 132 days.—K 6, p. 41.

(46) I have employed 5 people, A, B, C, D, and E, upon a piece of work. Now I am told that A, B, C, and D, can finiſh it in 13 days; A, B, C, and E, in 15 days; A, B, D, and E, in 12 days; A, C, D, and E, in 19 days; and B, C, D, and E, in 14 days; pray in what time may I reaſonably expect to have my work done by their all working together; and ſuppoſe I ſhould wiſh to diſcharge 4 of them, which of them

them would finish the work soonest, when left to himself?—Ans. They would all finish the work in $11\frac{4331}{10921}$ days, and B would finish it the soonest if left to himself.—K 8, p. 43.

(47) Twenty-six wedges of gold, weighing, with a due proportion of alloy, 34lb 3oz 11dwts 14gr, were brought to the Mint, to be coined into guineas; what is the weight of each wedge, admitting them equal, and how many guineas may be made out of the whole, supposing no loss in the metal, and that an ounce will make $3\frac{3}{4}$ guineas?—Ans. 1lb 3oz 16dwt $14\frac{1}{13}$gr weight of each wedge, and $1543\frac{27}{64}$ guineas may be made out of the whole.—K 29, p. 8.

(48) If $44\frac{1}{2}$ guineas make 1lb Troy, and 48 halfpence make 1lb Avoirdupois, what is the difference between the weight of a guinea and a halfpenny?—Ans. the weight of a halfpenny exceeds the weight of a guinea by $15\frac{3701}{6624}$grs.—K 86, p. 12.

(49) What number is that from which if $14\frac{3}{8}$ be deducted, the remainder will be $47\frac{9}{16}$?—Ans. $62\frac{3}{16}$.—K 3, p. 42.

(50) What number is that, from which if a twelfth part of 1728 be deducted, and the remainder increased by the 95th part of 82175, the sum will be 1185?—Ans. 464.—K 54, p. 4.

(51) Suppose the course of exchange between London and Madrid be $41\frac{7}{8}$d. sterling per piastre, at which time a bill of exchange is drawn by London; what would have been the gain or loss per cent. to London, had the bill been drawn when the exchange was at $53\frac{1}{2}$d. sterling per piastre, by comparing the latter negociation with the former?—Ans. 27l. 15s. $2\frac{1}{2}$d. $\frac{50}{67}$ gain per cent.—K 76, p. 125.

(52) An old lady left 220l. 13s. 4d. to be divided among 3 of her nieces, A, B, and C, thus; as often as A had $5\frac{1}{2}$l. B had $4\frac{3}{7}$l; and, as often as B had $4\frac{1}{5}$l. C had $3\frac{2}{3}$; pray what money did the old lady leave to each of them?—Ans. 91l. 11s. $4\frac{1}{2}$d. $\frac{2038400}{2577360}$ A's share; 72l. 19s. $10\frac{1}{2}$d. $\frac{806400}{2577360}$ B's share. 65l. 2s. $0\frac{1}{2}$d. $\frac{1702400}{2577360}$ C's share.—K 11, p. 101.

(53) X, Y, and Z, in company, make one common stock of 4262l.; X's money was in 4 months; Y's 6 months, and Z's 9 months. They gained 420l. which was to be divided in the following manner, viz. $\frac{1}{2}$ of X's gain to be equal to $\frac{1}{3}$ of Y's; and $\frac{1}{3}$ of Y's gain to be equal to $\frac{1}{4}$ of Z's.—Quere what each person gained and put in?—Ans.

	l.	s.	d.		l.	s.	d.	
X's gain	93	6	8	his stock	1475	6	$1\frac{3}{4}\cdot\frac{360}{1456}$	K 9, p. 106
Y's —	140	0	0	———	1475	6	$1\frac{3}{4}\cdot\frac{360}{1456}$	
Z's —	186	13	4	———	1311	7	$8\frac{1}{4}\cdot\frac{336}{1456}$	

(54) A gen-

(54) A gentleman bought 3 ſuits of clothes, containing $7\frac{2}{3}$ yards each; the firſt ſuit coſt 17s. per yard, the ſecond $\frac{5}{6}$ of 17s. and the third $\frac{3}{4}$ of 17s. what did the whole coſt him?—Anſ. 16l. 16s. $8\frac{1}{4}$d. $\frac{1}{3}$.—K 2, p. 42.

(55) Suppoſe I have $\frac{5}{16}$ of a ſhip, worth 16000l. what part of her ſhall I have left, if I diſpoſe of $\frac{3}{8}$ of $\frac{5}{11}$ of $\frac{1}{2}$, my ſhare; and what money is the part I have left worth?—Anſ. $\frac{805}{881}\frac{}{6}$ the part I have left, and the value thereof is 4573l. 17s. $3\frac{1}{4}$d. $\frac{1}{11}$.—K 5, p. 42.

(56) A grocer delivered 17cwt 3qr 10lb of tobacco in the roll, to be cut and dried; when it came home it weighed 16cwt 14lb.; how much was loſt in every lb; and, admitting it coſt $8\frac{1}{2}$d. per lb. in the roll, and $1\frac{1}{4}$d. per lb cutting, what does the whole now ſtand him in, and what muſt he ſell it for per lb to gain 10 guineas by it?—Anſ. 1oz $8\frac{1}{11}\frac{200}{999}$dr loſt in every lb; the whole ſtands him in 81l. 3s. $4\frac{1}{2}$d. and he muſt ſell it at 1s. od. $\frac{1}{1}\frac{3}{8}\frac{14}{06}$ per lb.—K 40, p. 18.

(57) A garriſon of 3600 men has juſt bread enough to allow 24oz a day to each man for 35 days; but, a ſiege coming on, the garriſon was reinforced to the number of 4800 men; how many ounces of bread a day muſt each man be allowed, to hold out 45 days againſt the ſiege of the enemy?—Anſ. 14oz per day.—K 5, p. 21.

(58) Lent my friend 20l. October 21, 1782; on the 22d of May, 1784, I borrowed of him 150l. and on July 30, in the ſame year, 150l. more; on July 21, 1785, I paid him 15l. 18s.; on Auguſt 21, 40l.; on October 21, 50l.; on February 13, 1786, I paid 9l. 12s.; on June 13, 111l.; and on January 13, 1787, 80l.; how ſtood our account at that period, allowing 5 per cent. ſimple intereſt for the money?—Anſ. the balance is 3l. 3s. $10\frac{1}{2}$d. in my favour.—K 36, p. 83.

(59)* Two merchants, A and B, join ſtock in trade; A puts 200l. B a certain ſum; in trading 4 years, they clear juſt 5l. per cent ſimple intereſt on their whole capital. They have equal ſhares of the profits, but A paid B 21l. 11s. $0\frac{3}{10}$d. compound intereſt on the ſum advanced above his ſhare. I demand B's ſtock, and each of their reſpective gains?—Anſ. B's ſtock is 400l. and their gains 60l. each; but if A pays B his intereſt, B's gain will be 81l. 11s. $0\frac{3}{10}$d.; and A's only 38l. 8s. $11\frac{7}{10}$d.

(60) The ſum of two numbers is 348, and their difference 194, required the numbers.—Anſ. 271 the greater, 77 the leſs.—K 51, p. 4.

(61) What

(61) What number, multiplied by 365, will produce 315725?—Anſ. 865.—K 52, p. 4.

(62) What number, multiplied by 95, will give the ſame product as 157 by 570?—Anſ. 942.—K 53, p. 4.

(63) Required the difference between ſix-dozen dozen, and half a dozen dozen.—Anſ. 792 diff.—K 56, p. 4.

(64) The globe of the earth, under the equinoctial line, is 360 degrees in circumference, each degree $69\frac{1}{2}$ miles; now, if the earth turn on its axis in 23hr 56m, at what rate per hour are the inhabitants upon the equator carried from weſt to eaſt by this rotation, and at what rate per hour are the inhabitants of London carried the ſame way?——The latitude of London is $51\frac{1}{2}$N. where a degree of longitude meaſures 37m 2ft 37p $5\frac{1}{2}$ft.—Anſ. The inhabitants upon the equator are carried 1045m $3\frac{83}{359}$ft per hour; and the inhabitants of London 562m 18p 8yd $2\frac{1}{2}$ft $\frac{47}{359}$.—K 29, p. 15.

(65) How long would 500 people be in counting a billion of money, ſuppoſing each of them counted 100l. every minute (without intermiſſion,) the year conſiſting of 365 days, 6 hours?—Anſ. $38\frac{676}{2644588}$ years.—K 84, p. 11.

(66) An apprentice, who is 14 years, 11 months, 13 weeks, 14 days, 15 hours, 58 minutes old, is to ſerve his maſter till he is 21 years of age. How long has he to ſerve?—Anſ. 5y 11m 6d 8h 22m.—K 59, p. 6.

(67) Sold 500l. worth of goods to 5 different perſons, viz. 100l. worth each; the firſt man pays at one year's end, the ſecond at two, the third at three, the fourth at four, and the fifth at five years end. Now, if I allow each of them a diſcount of 6 per cent. for preſent payment, what ſhall I receive for my 500l.; and, ſuppoſing that I am not in immediate want of the money, and have no fear of loſing any part of it, whether will it be better to receive the debts as they become due, and put them out to intereſt, at 6 per cent. till the end of five years; or to receive their preſent value, and put it out to intereſt at the rate of 6 per cent. till the end of five years?—Anſ. 425l. 18s. $9\frac{1}{2}$d. preſent worth of the debts; and 560l. may be made by receiving the money as it becomes due; hence the advantage is 61. 5s. $7\frac{1}{4}$d.—K 12, p. 91.

(68) What number is that from which if you deduct $\frac{5}{8}$ of $\frac{3}{7}$, and to the remainder add $\frac{7}{11}$ of $\frac{3}{19}$, the ſum will be 45?—Anſ. $45\frac{19559}{117304}$.—K 6, p. 43.

(69) A gentleman had two ſons; to the elder he left $\frac{3}{7}\frac{5}{9}$ of his eſtate, and $\frac{3}{7}\frac{5}{9}$ of the remainder to the younger ſon; the reſidue was allotted to the widow; now, if the elder ſon had 500l. more than the younger, pray what was left for the widow,

dow, and what was the gentleman's whole eſtate worth?—Anſ. 790l. 4s $0\frac{3}{4}$d. $\frac{45}{49}$ the widow's ſhare, and 2547l. 6s. $11\frac{1}{4}$d. $\frac{3}{49}$ the value of the whole eſtate.—K 13, p. 48.

(70) If a wall of $57\frac{3}{8}$ yards long, $12\frac{7}{12}$ feet high, and $1\frac{1}{2}$ brick thick, coſt 342l. 15s. building, what will a wall of $34\frac{5}{8}$ yards long, $11\frac{1}{4}$ feet high, and $2\frac{1}{2}$ bricks thick, coſt at the ſame rate per rod?—Anſ. 308l. 4s. $2\frac{3}{4}$d. $\frac{2}{2}\frac{3}{5}\frac{19}{67}$.—K 14, p. 48.

(71) A merchant ſent goods to Boulogne to the value of 3475l. 15s. by the ſale of which he gained 40l. ſterling per cent. The value of the goods he ſent over, and the gain, were returned in commodities, by the ſale of which in England, he loſt 15l per cent. what was his gain at laſt?—Anſ. 660l. 7s. $10\frac{1}{5}$d.—K 33, p. 113.

(72) Sold a piece of cloth, containing 5000 ells Flemiſh, for 4250 guineas, and gained upon every yard $\frac{1}{8}$ of the prime coſt of an Engliſh ell. What did the whole piece ſtand me in?—Anſ. 3859l. 9s. $2\frac{1}{4}$d. $\frac{3}{37}$.—K 34, p. 113.

(73) A butcher has 22 oxen, each weighing $238\frac{1}{2}$ ſtone, eight pounds to the ſtone, to be cut out for ſea ſervice into pieces of 14lb, of 26lb, of 22lb, of 30lb, of 16lb, and of 15lb, and to have an equal number of each; how many pieces will theſe oxen produce, allowing nothing for waſte?—Anſ. 341 of each, and 33lb over.—K 81, p. 10.

(74) Suppoſe A can do a piece of work in $6\frac{1}{2}$ days, B can do the ſame in $4\frac{1}{4}$ days, and C in $3\frac{1}{3}$ days; if you ſet them all at work together, in what time will they finiſh it?—Anſ. $1\frac{68}{152}\frac{7}{3}$ days.—K 7, p. 43.

(75) The neat value of a hhd of Barbadoes ſugar was 4l. 14s. 6d. The cuſtom and fees 2l. 11s. 4d. Freight 1l. 1s. 6d. Factorage 5s. 9d. The groſs weight was 11cwt 1qr 15lb. Tare $11\frac{1}{5}$lb per cwt. Pray what was the ſugar rated at per cwt neat, in the bill of parcels?—Anſ. 16s. $10\frac{1}{2}$d. $\frac{20}{22}\frac{4}{9}\frac{2}{5}$.—K 28, p. 77.

(76) Lent 500 guineas at $4\frac{1}{2}$ per cent per annum ſimple intereſt, which by the 25th of September, 1788, was raiſed by the intereſt to 700l. 15s. Pray on what day, and in what year did I lend the money?—Anſ. April 18, 1781.—K 37, p. 84.

(77) Two perſons traded together; the difference of their ſtocks was 51l. 11s. 6d.—A's gain was 57l. 18s. and B's 29l. 14s. required each perſon's ſtock?—Anſ. 105l. 17s. $10\frac{1}{4}$d. $\frac{29}{47}$ A's ſtock, and 54l. 6s. $4\frac{1}{4}$d. $\frac{29}{47}$ B's ſtock.—K 13, p. 101.

(78) Sold a quantity of Virginia ſnake root for 20l. and by ſo doing loſt 20l. per cent. whereas I ought to have gained

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as much per cent as the ſnake-root coſt.—Quere, my loſs in point of trade?—Anſ. 11l. 5s.—K 30, p. 112.

(79) A bartered tobacco, worth 3s 4d. per lb, at 3s. 9d. per lb. with B, for tea, at 6s 3d. per lb. When A ſold the tea, he found himſelf a gainer of 17l 6s. 8d. per cent. and in the whole 8l. 10s. 8d. What did A ſell the tea for per lb, and what quantity of tobacco and tea were bartered?—Anſ. A ſold his tea at 7s. 4d. per lb. and the number of lbs of tobacco bartered were 160, and of tea 96.—K 18, p. 116.

(80) What part of 108 is $\frac{5}{12\frac{5}{2}}$ of an unit?—Anſ. $\frac{5}{1296}$.—K 13, p. 39.

(81) What number is that, which if multiplied by $\frac{2}{8}$ of $\frac{3}{7}$ of $15\frac{1}{8}$, will produce only $\frac{5}{8}$ of an unit?—Anſ. $\frac{56}{363}$.—K 14, p. 39.

(82) A merchant at London is deſirous of transfering a ſum of money to Amſterdam in the moſt advantageous manner, either directly to Amſterdam, or through Paris, at a time when the courſe of exchange between London and Amſterdam is 34s. 5d. per £. ſterling; and between London and Paris $31\frac{1}{4}$d. ſterling per crown. By advice, he finds the courſe of exchange between Paris and Amſterdam to be 52d. Flemiſh per crown, upon which he remits directly to Amſterdam, and draws for the value upon Paris. What does he gain per cent. by theſe means; and what would he have loſt per cent. had he remitted the money to Amſterdam by way of Paris, and then drawn upon Amſterdam for the value, ſuppoſing he had received no advice of the courſe of exchange between Paris and Amſterdam?—Anſ. 3l. 8s. $3\frac{1}{2}$d. $\frac{11}{13}$ gain per cent. by remitting to Amſterdam and drawing upon Paris; and he would have loſt 3l. 6s. $0\frac{1}{2}$d. $\frac{230}{411}$ per cent. had he remitted to Paris and drawn upon Amſterdam.—K 81, p. 125 and 126.

(83) A reſervoir has three cocks, A, B, and C, to let in water, and three others, D, E, and F, to diſcharge it; now, if A be opened by itſelf, the reſervoir, when empty, will be filled in 6 hours; if B be opened by itſelf, it will be filled in 8 hours; and, if C be opened by itſelf, it will be filled in 10 hours. Again, if D be opened by itſelf, when the reſervoir is full, it will be emptied in 9 hours; if E be opened by itſelf, it will be emptied in 11 hours; and, if F be opened by itſelf, it will empty the reſervoir in 13 hours. In what time will the empty reſervoir be filled, if all the cocks, A, B, C, D, E, and F, are ſet open together; admitting the weight of the column of water in the reſervoir, and the preſ-

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ſure of the atmoſphere to be uniform, during the influx and efflux of the water?—Anſ. 8hrs. 52m. $16\frac{3}{5}\frac{3}{8}\frac{2}{3}$ ſeconds.—K 9, p. 44.

(84) What is the difference between $\frac{3}{8}$ of $\frac{5}{6}$ of a crown, and $\frac{3}{5}$ of $\frac{9}{10}$ of a guinea?—Anſ. 9s. $9\frac{1}{2}$d. $\frac{8}{15}$.—K 10, p. 45.

(85) Bought 19cwt 1qr 27lb groſs of tobacco in leaf, at 5l. 0s. 4d. per cwt neat, and 12cwt 3qr 19lb groſs in rolls, at 5l. 17s. 8d. per cwt. The tare of the former was 149lb. and the latter $48\frac{1}{2}$lb. what did the tobacco ſtand me in?—Anſ. 164lb. 11s. $4\frac{1}{2}$d.—K 24, p. 76.

(86) If 100l. in 11 years gain 38l. 10s. ſimple intereſt, in what time would any other ſum gain as much intereſt as will make its amount 5 times the principal?—Anſ. $114\frac{2}{7}$ years.—K 38, p. 84.

(87) A gentleman employed a broker to purchaſe 70,000l. 3 per cent. annuities, for the reſcounters, at 61 per cent.—Some little time after the *honeſt* broker informs his employer, that the 3 per cents are fallen 4 per cent below the price he bought at, and that the houſe are *bulls* for the *reſcounters*; upon which the gentleman orders him to ſell out, at $56\frac{1}{2}$ per cent. What did the broker gain by this manœuvre, allowing him $\frac{1}{8}$ per cent. for buying and ſelling; and what did the gentleman loſe?—Anſ. The *honeſt* broker gained 175l. and the gentleman loſt 3325l.—K 8, p. 87.

(88) Three merchants traded together as follow; A put in 500l. for three months; B 350l. for 5 months; and C 400l. for 2 months, by which he received 29l. 12s. $7\frac{1}{9}$d. profit.—what muſt A and B receive for their reſpective ſtocks, and what did they gain in the whole?—Anſ. 55l. 11s. $1\frac{3}{9}$d. A's gain; 64l. 16s. $3\frac{5}{9}$d. B's gain; and 150l. the whole gain.—K 6, p. 105.

(89) A tea-dealer purchaſed 120lb of tea, $\frac{2}{5}$ of which he ſold at half a guinea per lb. but the reſt being damaged, he ſold at a loſs of 3l. 12s. after which he found he had neither gained nor loſt.—What did the tea coſt him per lb. and what was the damaged tea ſold for?—Anſ. the tea coſt 9s. per lb. and the damaged tea ſold for 28l. 16s.—K 31, p. 113.

(90) What difference is there between the ſimple intereſt of 500l. for $4\frac{3}{4}$ years, at 5 per cent, and half that ſum twice the time, at half the ſame rate per cent?—Anſ. 59l. 7s. 6d.—K 39, p. 84.

(91) A gentleman ſent to his goldſmith 18 ingots of ſilver, each weighing 3lb 7oz 14dwts 21gr, with orders to make it into tankards of 18oz 14dwts 10gr each, cups of 19oz 15dwts 11gr each, ſpoons of 24oz 10dwts 14gr per dozen, ſalts of

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4oz 12dwts each, forks of 22oz 11dwts 14gr per dozen; for every tankard he was to make one cup, a dozen ſpoons, 1 ſalt, and a dozen forks; how many of each will it make, allowing 7oz 1dwt 14gr for droſs; and what quantity of ſilver will there be left?—Anſ. 8 of each, and 580z 13dwts 20gr of ſilver left.—K 83, p. 11.

(92) According to our preſent chronology, the year conſiſts of 365 days for three years ſucceſſively, and 366 days every fourth, or $365\frac{1}{4}$ days at a mean; and the ſolar year, according to the beſt aſtronomical calculation, conſiſts of 365 days, 5 hours, 48 minutes, 55 ſeconds. Required in how many years, reckoning from Chriſtmas 1788, the ſeaſons of the year will be quite reverſed, viz. how many years will elapſe before Chriſtmas will fall upon Midſummer, without ſome alteration in the chronology?—Anſ. $23727\frac{34}{65}\frac{5}{65}$ years.—K 85, p. 12.

(93) Required the exact time of the day between the hours of 2 and 3, when the hour and minute hand of a clock are both together, when they make an angle of 90 degrees, or are 15 minutes apart; and at what o'clock will they be exactly together a ſecond time?—Anſ. They will be exactly together at $10\frac{10}{11}$ minutes paſt 2 o'clock; at $27\frac{3}{11}$ minutes paſt 2 o'clock they will be 15 minutes a-part, and at $16\frac{4}{11}$ minutes paſt 3 o'clock they will be in conjunction again.—K 32, p. 16.

(94) If 12 oxen will eat $3\frac{1}{3}$ acres of graſs in 4 weeks, and 21 oxen will eat 10 acres in 9 weeks, how many oxen will eat 24 acres in 18 weeks, the graſs being allowed to grow uniformly?—Anſ. 36 oxen.—K 14, p. 22 and 23.

(95) A gave B 120 yards of kerſey, $3\frac{1}{2}$ yards of which coſt 15s. 9d. for ſtockings, at 7s. per pair, and hats at 6s. 6d. each; B gave A as many hats as pairs of ſtockings; how many of each did he give?—Anſ. 40 hats, and 40 pairs of ſtockings.—K 14, p. 115.

(96) A merchant in London remitted to Amſterdam 500l. ſterling, at the rate of 18d. ſterling per guilder; his correſpondent at Amſterdam was to remit the ſame, by order, to Bourdeaux, at 3 guilders per crown, rebating $\frac{1}{3}$ per cent for his commiſſion. But, when he received this order, the exchange between Amſterdam and Bourdeaux was at $3\frac{1}{2}$ guilders per crown. The merchant at London, not apprized of this, drew upon Bourdeaux at 55d. ſterling per crown; whether, did he gain or loſe, and how much per cent?—Anſ. he loſt 64l. 18s. $11\frac{1}{4}$d. $\frac{1}{63}$, and 12l. 19s. $9\frac{1}{4}$d. $\frac{53}{63}$ the loſs per cent. If the factor could have remitted to Bourdeaux as per

order, the merchant would have gained 7l. 11s. $2\frac{3}{4}$d. $\frac{7}{27}$.—K 83, p. 126.

(97) Multiply $\frac{1}{2}$ of $\frac{3}{5}$ of $5\frac{3}{8}$, $\frac{17\frac{1}{5}}{94}$, $\frac{14}{95\frac{3}{8}}$, and $\frac{5}{8}$ of 17, together, for the numerator of a fraction; and $\frac{14\frac{5}{9}}{17\frac{3}{5}}$, $\frac{4}{\frac{7}{9}}$, $\frac{\frac{7}{11}}{15\frac{1}{2}}$ and $51\frac{5}{8}$ together, for a denominator, and reduce the new fraction to its proper terms.—Anſ. $\frac{94299}{2049\,20}$ the numerator, $\frac{270515}{300\,08}$ the denominator, or $\frac{3537155\,49}{69292417\,25}$ the fraction required.—K 11, p. 45 and 46.

(98) A merchant of London has credit at Leghorn for 7547 piaſtres, whence he receives advice that a remittance can be made at 52d. per piaſtre. The merchant upon this orders them to be remitted to Venice at 95 piaſtres for 100 ducats banco; thence to Cadiz, at 321 maravedis per ducat; thence to Liſbon at 631 rez per piaſtre; thence to Amſterdam, at 50d. Flemiſh per cruſade; thence to Paris, at 56d. Flemiſh per ecu; and laſtly from Paris to London, at $31\frac{1}{2}$d. per crown. What ought to be the arbitrated price between London and Leghorn; whether will the merchant gain or loſe, and how much per cent by the circular exchange?—Anſ. Whole gain 97l. 19s. $5\frac{1}{4}$d. and the gain per cent 5l. 19s. $9\frac{3}{4}$d.—K 88, p. 128 and 129.

*(99) Crœſus preſented to the temple of the gods 6 cups of gold, which together weighed 600 drams; each cup was heavier than the other by one dram. Quere, what did each of them weigh?—Anſ. the firſt weighed $102\frac{1}{2}$ drams, the ſecond $101\frac{1}{2}$, the third $100\frac{1}{2}$, the 4th $99\frac{1}{2}$, the fifth $98\frac{1}{2}$, and the 6th $97\frac{1}{2}$ drams.

(100) If a ball of 18lb be ſhot from a cannon with ſuch a force as to ſend it 100 feet in a ſecond, with what velocity would a ball of 24lb move, were it impelled by the ſame force?—Anſ. 75 feet.—K 12, p. 19.

(101) A number of men drinking porter in London, ſpent at a reckoning half a crown and a farthing; when they came to pay the landlord, they found that each man had as many farthings to pay as there were men in company. Pray how many men were there, and what quantity of porter had each man to pay for, the price of a pint of porter being $1\frac{3}{4}$d. and the price of $\frac{1}{2}$ a pint a penny?—Anſ. there were 11 men, and each man had 11 farthings worth, or a pint and a penny-worth of beer to pay for?—K 19, p. 135.

(102) I have ordered my factor at Amſterdam to remit 1757l. 15s. Flemiſh, (the exchange between London and Amſterdam

ſterdam being 34s. 7d. Flemiſh per pound ſterling) to France, at 54d. Flemiſh per ecu; thence to Venice, at 100 crowns for 56 ducats banco; thence to Hamburgh, at 100d. Flemiſh per ducat; thence to Portugal, at 45d. Flemiſh per cruſade; and thence to London, at 63d. per milree. How much ſterling ought I to receive, allowing my factor $\frac{1}{2}$ per cent for commiſſion at each place; and whether will be the more advantageous, the circular, or the direct exchange?—Anſ. 1000l. 10s. 8d. ſterling ought to be received by the circular exchange, and 1016l. 10s. 7d. by the direct exchange; ſo that the direct method has the advantage by 15l. 19s. 11d.—K 89, p. 129 and 130.

(103) Two merchants, A and B, traded together with a ſtock of 315l. A's money was employed 12 months, and B's only 8; when they came to divide the profits of their traffic, they had equal ſhares. Pray what money did each merchant put into the ſtock?—Anſ. A put in 126l. and B 189l.—K 13, p. 108.

(104) Five boys, A, B, C, D, and E, put a number of marbles into a ring in order to play; but, a diſpute happening among them, A ſnatched $\frac{2}{5}$ of the marbles out of the ring; B ſnatched $\frac{3}{8}$ of thoſe out of his hand before he got off, and C, who was near, got $\frac{3}{5}$ of the remainder; D ran off with all A had left in the ring, except $\frac{1}{12}$ part, which E got. A and C, not ſatisfied with what they got, jointly ſet upon D, and ſnatched $\frac{7}{11}$ of what he had got from him, of which number B, in the ſcuffle, got $\frac{1}{5}$, and E the reſt; C ſnatched from E $\frac{1}{3}$ of the number he had then in h nd, and A got $\frac{1}{11}$ of what B had left. Here D obſerved that he had got juſt as many marbles as he put into the ring; and, if E would but give A $\frac{1}{11}$ of what he had got, he would try to prevail upon C to give him $\frac{3}{13}$ of what he then had, and then they would all have equal ſhares. Pray how many marbles were firſt put into the ring, ſuppoſing each boy put in an equal number, and none were loſt in the ſcuffle.—Anſ. 100 marbles.—K 12, p. 46 and 47.

(105) If, when wine is 30l. per tun, 20l. worth will ſerve a ſhip's company of 336 men for 4 days, at a pint a day for each man, how long will 500l. worth ſerve a crew of 250 men, at $1\frac{1}{2}$ pint a day to each man, when the tun is ſold for 24l.—Anſ. 112 days.—K 9, p. 21.

(106) Lent William Adamſon, per bill, (dated Auguſt 1ſt, 1786) payable two months after date, 957l. 18s. which I received as follows, viz. October 5th, 94l. 17s. November 27th, 47l. 19s. 6d. December 15th, 100 guineas. January

1ſt, 1787, 55l. 11s. 4d. March 15th, 101l. 14s. May 12th 105 guineas. Auguſt 19th, 140l. 2s. 6d. September 11th, 50l. os. 6d. and on March 15th, 1788, I received the balance of the principal. Pray what intereſt ought I to claim at 4 per cent. ſimple intereſt?—Anſ. 27l. 15s. $10\frac{1}{4}$d.—K 40, p. 85.

(107) If 1 cwt of cheeſe coſt 1l. 17s. 4d. what is that per lb?—Anſ. 4d.—K 12, p. 21.

(108) If 100lb. weight of England make 88lb. at Rouen; 78lb. at Rouen 94lb. at Lyons; 69lb. at Lyons 53lb at Geneva; 72lb. at Geneva 100lb. at Marſeilles; 121lb. at Marſeilles 100lb. at Hamburgh; 103lb. at Hamburgh 101lb. at Paris. What is the difference between the weight of a lb. at London and Paris?—Anſ. 1oz $5\frac{770024}{5744017}$drs. the Paris lb. exceed the Engliſh avoirdupois lb. or the Engliſh lb. is to the Paris lb. as 100 is to 109 nearly.—K 90, p. 130.

(109) A factor in London is ordered to remit to Venice at 50d. per ducat, and to draw for the value upon Madrid at 42d per dollar; but on receipt of the order, bills upon Venice were at $53\frac{1}{2}$d. At what rate muſt he draw upon Spain to compenſate this loſs?—Anſ. $39\frac{27}{70}$d. per dollar.—K 80, p. 125.

(110) Bought 7hhds of treacle, each weighing 4cwt, 3qr, 17lb. groſs, tare 17lb. per cwt. break 8lb. per hhd, and damage in the whole $99\frac{3}{4}$lb. what is the value at 1l. 17s. 6d. per cwt. neat?—Anſ. 51l. 19s. 3d.—K 26, p. 77.

(111) Three merchants, A, B, and C, freight ſhips to Liſbon with ſugar, to the value of 15778l. 2s. 6d. A bought 250cwt, 1qr, 22lb, at 2l. 16s. per cwt. B paid 2l. 6s. 8d. per cwt. for his; but, meeting with a ſtorm at ſea, the ſailors were under the neceſſity of caſting out part of the ſhip's lading. A's proportional part caſt overboard was equal to the $\frac{1}{100}$ part of their whole cargo, and $3\frac{3}{4}$ times the whole quantity caſt overboard was equal to $3\frac{1}{3}$ times the whole freight of A and B. When they came to land, A ſold his remaining part for 4 guineas per cwt. and found himſelf a loſer 10 per cent. beſides charges. B advanced the remaining part of his commodity 20 per cent. and C gained 4s. 8d. per cwt. by the quantity he ſaved. What did each merchant loſe by this voyage, the charge thereof amounting to 500 guineas? Anſ. 83l. 5s. 0d. A's whole loſs, 3004l. 15s. B's whole loſs, and 1574l. 7s. 6d. C's whole loſs.—K 14, p. 102.

(112) Bought 127 hhds of ſugar, each containing $4\frac{1}{2}$cwt. at 3l. os. 8d. per cwt. how muſt I ſell the ſugar per lb. to

gain

gain 50 guineas by the whole?—Anſ. $6\frac{1}{2}$d. $\frac{100}{127}$.—K 27, p. 112.

(113) There are three towers, A, B, C, ſtanding in a direct line, the heights whereof are 64, 90·249, and 50, feet reſpectively. The diſtance between the top of the tower A and that of B, is 97 feet; and the diſtance between the bottom of the tower B and that of C is 76 feet. By theſe data it is required to find the diſtances the tops and bottoms of the towers are from each other?—Anſ. 93·3808ft. the diſtance of the bottom of the tower A from that of B; 169·3808 its diſtance from the bottom of C; 169·958 the diſtance of the top of the tower A from that of C; and 85·999 the diſtance of the top of the tower B from that of C.—K 22, p. 135 and 136.

(114) A merchant bought 1400 caſks of tallow, at 2l. 5s. per caſk, and ſold one half of it at 2l. 15s. per caſk; but the reſt being worſe than he expected, he is willing to ſell it at ſuch a price per caſk, that he may exactly make his purchaſe-money of the whole. At what rate muſt he ſell it?—Anſ. 1l. 15s.—K 28, p. 112.

(115) Suppoſe London exchanges with Portugal for the milre at 5s. 6d. ſterling; and afterwards at 5s. $1\frac{1}{2}$d. What is gained or loſt per cent. by the latter negociation, when compared with the former?—Anſ. 6l. 16s. $4\frac{1}{4}$d. $\frac{5}{11}$ loſs per cent.—K 75, p. 125.

(116) Three merchants traded together in this manner; A's money continued 8 months, for which he received 44l. 4s gain; B's continued 6 months, for which he received 42l. 16s. 9 $\frac{3}{5}$d; and C's 12 months, by which he was entitled to receive 79l. 11s. $2\frac{2}{5}$d.—Their whole ſtock was 227l. hence is required each perſon's particular ſtock?—Anſ. 65l. A's ſtock, 84l. B's, and 78l. C's.—K 7, p. 105 and 106.

(117) In 29 parcels, each weighing 3cwt, 3qr, 14lb, groſs, tare 8lb per cwt, tret 4lb per 104lb, and cloff 2lb per 3cwt; how much neat weight, and what is the value at a guinea and a half per cwt?—Anſ. 99cwt, 2qr, 27·604lb neat, and the value 157l. 2s —K 27, p. 77.

(118) My factor at Leghorn returned me 800 barrels of anchovies, each weighing 14lb neat, worth $12\frac{1}{2}$d. per lb, in lieu of 7490lb of Virginia tobacco; by which conſignment I find that I have gained 17l. per cent.—Pray what was the prime coſt of a lb of my tobacco to the factor?—Anſ. $15\frac{1}{4}$d. $\frac{791}{847}\frac{21}{763}$ the real value per lb.—K 32, p. 113.

(119) A Spaniſh merchant ordered his factor in London to remit the value of 900 ducats to Venice, at $50\frac{1}{4}$d. per ducat,

and to draw upon him at Madrid for the value, at 41d. per piaſtre. When the order arrived, the exchange at Venice was at 51d. per ducat, and at Spain at 42$\frac{1}{4}$d. per piaſtre; whether did the merchant gain or loſe by this negociation? Anſ. 16$\frac{45}{69}$$\frac{61}{29}$ piaſtres loſs.—K. 82. p. 126.

(120) A gentleman hired a number of labourers, at a ſhilling per day each, to dig a fiſh-pond. When they had finiſhed their work their wages amounted together to 120l. 1s.—What was the wages of one man? each man worked as many days as there were men in company. Anſ. 2l. 9s.—K. 18. p. 135.

(121) Two merchants have various kinds of goods to barter; A has 735 yards of India ſilk, worth 8s. 6d. per yard, 532 canes, worth 3s. each, and 16 pieces of muſlin, worth 4l. each; B has ſcarlet cloth worth 1l. per yard, glaſs manufacture at 1s. 8d. per lb. and a finer kind at 2s. 4d. per lb. How many yards of cloth and pounds of each ſort of glaſs muſt B give A? admitting that he gives as many pounds of each ſort of glaſs as he gives yards of cloth. Anſ. 380 $\frac{7}{48}$ of each.—K 15. p. 115 and 116.

(122) A banker in Paris remits to his factor at Amſterdam 7547 crowns, 15 ſols tournois; firſt to London, at 30d. per crown; thence to Rome, at 65d. per ſtampt crown; thence to Venice, at 100 ſtampt crowns for 142 ducats banco; thence to Leghorn, at 105 ducats banco for 100 piaſtres; and from Leghorn to Amſterdam, at 87d. Flemiſh, per piaſtre. How many guilders banco will be received at Amſterdam, and what will the banker gain, ſuppoſing the direct exchange between Paris and Amſterdam to be 51d. Flemiſh per ecu? Anſ. 10246 guilders 0 ſt. 4$\frac{204}{455}$ pen will be received at Amſterdam by the circular exchange, which is more advantageous than the direct exchange by 623 guild. 5 ſt 6 $\frac{204}{455}$.—K 86. p. 127.

(123) Camillus, the Roman general, after conquering the city of Veii, and other ſervices done to his country, was, through the enmity and avarice of the tribunes, fined fifteen hundred *aſſes*, value 4l. 13s. 9d. ſterling. Pray what was the value of an *aſs* in Engliſh money? Anſ. $\frac{3}{4}$.—K 32. p. 9.

(124) A, B, and C, are in company, and put in together 3822l.; A's money was in three months, B's money was in five months, and C's money was in ſeven months; they gained 234l. which was ſo divided, that $\frac{1}{2}$ of A's gain was equal to $\frac{1}{3}$ of

$\frac{1}{3}$ of B's gain, and $\frac{1}{3}$ of B's gain was equal to $\frac{1}{4}$ of C's gain; what did each merchant gain and put in?

£.		£.	s.	d.		
52	A's gain	1386	4	$4\frac{44}{109}$	A's ſtock	K 8. p. 106.
78	B's ——	1247	11	$11\frac{1}{109}$	B's ——	
104	C's ——	1188	3	$8\frac{148}{109}$	C's ——	

(125) A bill of exchange was drawn upon Amſterdam, when the courſe of exchange was 34s. 3d. Flemiſh per £. ſterling; and, ſome time after, another was drawn, when the courſe of exchange was 33s. 6d. Flemiſh per £. ſterling; what was gained or loſt per cent. by this negociation, when compared with the former? Anſ. 2l. 3s. $9\frac{1}{2}$d. $\frac{26}{137}$ loſs per cent.—K 73. p. 248.

*(126) Suppoſe a crown that ſhall weigh 60lb. is to be made of gold, braſs, iron, and tin, mixed together, in ſuch proportion, that the weight of the gold and of the braſs together may be 40lb. the joint weight of the gold and of the tin 45lb. and the joint weight of the gold and of the iron 36lb. The queſtion is, how much of every one of theſe four metals muſt be taken? Anſ. $30\frac{1}{2}$lb of gold, $9\frac{1}{2}$lb. of braſs, $5\frac{1}{2}$lb. of iron, and $14\frac{1}{2}$lb. of tin.

*(127) Two footmen, A and B, ſet off at the ſame time, from London towards York, A went 8 miles every day, and B 1 mile the firſt day, 2 miles the ſecond day, 3 miles the third day, &c. travelling in every following day one mile more than in the preceding day; the queſtion is to know in how many days B will overtake A?—Anſ. 15 days.

*(128) A young man received $66\frac{2}{3}$l. which was $\frac{2}{3}$ of $\frac{1}{2}$ of his elder brother's portion, and $3\frac{1}{2}$ times of his elder brother's portion was $1\frac{1}{4}$ times his father's eſtate; the queſtion is, what was the father's eſtate?—Anſ. 560l.

*(129) The expence of hurdles, at 9d. each, for folding 100 ſheep, came to 3l. 15s. pray what will be the expence of enlarging the fold to hold 200 ſheep, when hurdles are at $9\frac{1}{4}$d. each?—How many hurdles will fold 200 ſheep, and what ſort of a fold muſt be made that it may take the feweſt hurdles poſſible, and, conſequently, be the leaſt expenſive?—Anſ. the expence of enlarging the fold will be 1s. $6\frac{1}{2}$d. and 102 hurdles will fold 200 ſheep in a rectangular form.

*(130) What will be the expence of white-waſhing three rooms, each 9 ft high, 27 ft long, and 18 ft wide; the three doors each 6 ft 6 in by 3 ft 9 in, and 9 windows each 6 ft by 4 ft 9 in, at $2\frac{1}{2}$d per yard?—Anſ. 4l. 2s. $4\frac{1}{4}$d.

*(131) A factor

*(131) A factor would exchange 780l. ſterling for ducats, dollars, and French crowns, the ducats at 7s. 6d. each, the dollars at 4s. 4d. and the Freneh crowns at 6s. each; to be in ſuch proportion that half the number of ducats may be equal to one third of the number of dollars, and $\frac{1}{4}$ of the number of dollars equal to $\frac{3}{10}$ of the crowns; how many pieces of each coin will he receive?—Anſ. 600 ducats, 900 dollars, and 1200 crowns.

*(132) A man and his wife found, by experience, that a barrel of beer, which laſted them both 12 days, would ſerve him, in her abſence, 20 days; how long would it laſt the wife, in her huſband's abſence, ſuppoſing, when alone, they drank exactly the ſame quantity each as when together?—Anſ. 30 days.

*(133) Divide the number 10 into two ſuch parts, that when the greater is divided by the leſs the quotient may be 20.—Anſ. $\frac{10}{21}$ and $\frac{200}{21}$.

*(134) A rectangular room, of $50\frac{1}{2}$ feet in circuit, and $8\frac{1}{4}$ ft high is to be furniſhed with hangings of ell broad ſtuff, at 3s. 4d. per yard, what will be the expence? no deductions to be made, except for one window of 5 ft high and 4 ft broad.—Anſ. 5l. 17s. $6\frac{2}{9}$d.

*(135) A merchant bought two ſorts of cloth, the one black, the other white, for 68l. 2s. he gave a guinea a yard for the black, and 12 ſhillings a yard for the white; he bought ſuch a quantity of each, that $\frac{5}{6}$ of the number of yards of the black were equal to $\frac{7}{8}$ of the white; how many yards did he buy of each ſort?—Anſ. 42 yards of black and 40 yards of white.

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